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INTERIM FINAL

STRUCTURES PROGRAM MANAGEMENT PLAN FOR THE U.S. ARMY BASE REALIGNMENT AND CLOSURE PROGRAM

Submitted to:

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MD 21020

Submitted by:

AGEISS Environmental, Inc.
1900 Grant Street, Suite 1130
Denver, CO 80203

USAEC Contract DAAA15-93-D-0006
Delivery Order 0002

September 23, 1994

Unlimited Distribution
Approved for Public Release

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LISTS OF ABBREVIATIONS/ACRONYMS

<	Less than
>	Greater than
ABS	Fraction of contaminant absorbed through the skin
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos Containing Material
AEHA	U.S. Army Environmental Hygiene Agency
AEHSC	U.S. Army Engineering and Housing Support Center
AHERA	Asbestos Hazard Emergency Response Act
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
Army	U.S. Army
ARRP	Army Radon Reduction Program
BDAT	Best Demonstrated Available Technology
BRAC	Base Realignment and Closure
BW	Body Weight
c	Measured concentration of a particular contaminant
CAA	Clean Air Act
CAMU	Corrective Action Management Unit
CCW	Constituent Concentration in Waste
CCWE	Constituent Concentration in Waste Extract
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
CI	Confidence Interval
cm^2	square centimeter(s)
cm	centimeter(s)
CMS	Corrective Measures Study
CV	Coefficient of Variance
DE	Daily Exposure Factor
DERP	Defense Environmental Restoration Program
df	Degrees of Freedom
DOAL	Dust Occupational Assessment Limit
DOD	U.S. Department of Defense
DRE	Destruction and Removal Efficiency
EA	Environmental Assessment
EBS	Environmental Baseline Survey
EIS	Environmental Impact Statement
E_m	Exposure for a mixture
ENPA	Enhanced Preliminary Assessment
EPA	U.S. Environmental Protection Agency
FNSI	Finding of No Significant Impact
FOSL	Finding of Suitability to Lease
FOST	Finding of Suitability to Transfer
FS	Feasibility Study
ft	foot or feet

LISTS OF ABBREVIATIONS/ACRONYMS (Continued)

ft^2	square foot or square feet
FY	Fiscal Year
HOC	Halogenated Organic Compound
ING	Ingestion rate
IRDMIS	Information Restoration Data Management Information System
IRP	Installation Restoration Program
kg	kilogram(s)
L	Assessment criteria for the contaminant
LDR	Land Disposal Restriction
MACOM	Major Command
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	Natural Emissions Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PCB	Polychlorinated biphenyl
pCi/L	picocuries per liter
PEL	Permissible Exposure Limit
PL	Public Law
POC	Principal Organic Constituent
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
REC	Record of Environmental Consideration
RFA	RCRA Facility Assessment
RfD	Reference Dose
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RMA	Rocky Mountain Arsenal
ROD	Record of Decision
RT	Regulatory Threshold
SF	Cancer Slope Factor
SHPO	State Historic Preservation Officer
SI	Site Inspection
SPMP	Structures Program Management Plan
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
µg	microgram(s)
USAEC	U.S. Army Environmental Center
USAMC	U.S. Army Materiel Command

EXECUTIVE SUMMARY

The U.S. Army Environmental Center (USAEC) initiated the development of the interim final Structures Program Management Plan (SPMP) to guide the conduct of environmental investigations related to structures at installations in the Base Realignment and Closure (BRAC) Program.

Because there are numerous and at times overlapping requirements for conducting environmental investigations related to base closure, a variety of approaches, procedures, and methodologies have been developed to generate essentially the same environmental data on BRAC structures. The primary objective of the SPMP is to provide base environmental coordinators with standard and uniform procedures to consider in characterizing and managing BRAC structures during the base closure process. The goal in developing the standardized procedures is to integrate the various required investigations so that one or just several data collection and analysis efforts can support all requirements.

This document presents the interim final SPMP, and focuses on the five primary environmental issues related to structures in base closure, namely characterization and management of asbestos, radon, polychlorinated biphenyls (PCBs), lead-based paint, and "process contaminants" (any contaminant present due to facility operation). Chemical agent and radioactive contaminant (other than radon) issues are not addressed in this plan. Pipelines, utilities, and infrastructure are also not considered in this plan. The term structures as used in this document is synonymous with buildings.

Because the U.S. Army (Army) requires full environmental compliance, the SPMP procedures are driven by Federal statutory, regulatory, and policy guidance requirements. For asbestos, radon, PCBs, and lead-based paint within BRAC structures, the overall requirements include inventories and surveys, with removal, treatment, or other mitigation options necessary when threats to human health and the environment are indicated. For process contaminants within BRAC structures, a more complex set of requirements exists and are best applied separately to structures with a future use and those with no future use. For the former, occupational health standards apply (assuming no residential habitation for operational buildings). For structures with no future use (which will likely be demolished or treated), disposal, solid and hazardous waste determinations, and other requirements of the Resource Conservation and Recovery Act (RCRA) apply.

State and local requirements may be more stringent than Federal counterparts. It is important to note that, in some circumstances, Federal, State, and local environmental regulations either do not apply or are vague, while local real estate sales practices and disclosure requirements are the driving forces in shaping environmental investigations and subsequent reporting activities.

The SPMP is comprised of a series of flow charts and explanatory text that describe procedures to consider in characterizing BRAC structures. The flow charts, which include an overall structures management chart and individual charts for the five environmental issues, are advisory only, and are designed for use as a tool in understanding both the full range of requirements as well as specific procedures suggested for each issue.

For the overall process, the procedures are integrated between the major environmental investigations required for structures in base closure, namely the following: 1) Enhanced

Preliminary Assessments and Comprehensive Environmental Response Facilitation Act investigations that are preliminary characterization steps for property in the BRAC program; 2) Environmental Baseline Surveys and Site Investigations that may be associated with determinations to lease or transfer real property; 3) Remedial Investigations and Feasibility Studies associated with property undergoing the Installation Restoration Program or Superfund processes; and 4) RCRA Facility Assessments or RCRA Facility Investigations and Corrective Measure Studies or RCRA Closure Plans associated with sites undergoing remediation under the RCRA process.

The specific procedures for asbestos, radon, PCBs, and lead-based paint are primarily an integration and summarization of existing regulations and U.S. Department of Defense and Army guidance (augmented where current requirements are silent). However, for process contaminants where there is a general lack of available guidance, new procedures have been developed for the SPMP. For future use structures, a primary focus in the procedures is the comparison of contaminant levels to published occupational standards (for airborne contaminants) and to newly developed health-based occupational assessment limits (for dust contaminants). Procedures to accomplish this comparison are expected to significantly assist base environmental coordinators in answering the question of "when is a future use structure clean?" For no future use structures, the procedures focus on sampling and treatment at both the predemolition and post-demolition stages, and sampling of treatment residuals, all in the context of regulatory requirements.

Comments provided by USAEC on the draft SPMP have been incorporated into this interim final version.

1.0 INTRODUCTION

This document presents the interim final Structures Program Management Plan (SPMP) prepared for the U.S. Army Environmental Center (USAEC). The USAEC directed AGEISS Environmental Inc., under the provisions of Contract DAAA15-93-D-0006, Delivery Order 0002, to develop the SPMP to be a comprehensive plan to manage environmental investigations of structures at installations included in the Base Realignment and Closure (BRAC) Program.

1.1 OBJECTIVES

The USAEC has recognized that compliance with the numerous statutory, regulatory and policy guidance requirements related to lease or transfer of structures at BRAC installations is a challenging effort. A substantial amount of documentation is necessary to support not only the Federal decision-making process related to disposal of BRAC properties, but also local environmental and real estate procedures and requirements. A complex set of Federal civilian and military environmental investigations has been mandated to provide the required environmental documentation.

The required environmental investigations contain overlapping and interrelated requirements for structures characterization. However, the investigations are typically conducted separately, often by different contractors at different times. As a result, a variety of approaches, procedures, and methodologies have been developed to generate essentially the same set of environmental data for BRAC structures. The primary objective of the SPMP is to avoid redundant data acquisition and analysis efforts by developing an overall approach to characterization of BRAC structures that uses standard and uniform procedures to the greatest extent possible. The goal in developing the standardized procedures is to integrate the various required investigations so that one or just several data collection and analysis efforts can support all requirements.

This document is intended for use as a management tool to guide technical actions related to structures at BRAC installations. This document is not designed to be used solely in conjunction with any particular funding mechanism for compliance with environmental requirements related to lease or transfer of structures at BRAC installations.

1.2 SCOPE

The scope of the SPMP includes environmental data necessary to comply with Federal requirements related to the five primary environmental issues that must be addressed in characterizing BRAC structures for disposal:

- Asbestos and asbestos containing material (ACM)
- Radon
- Polychlorinated biphenyls (PCBs)
- Lead-based paint
- Process contaminants

The scope of the SPMP is limited to structures, which are defined in this document to be synonymous with buildings. Utilities and pipelines are not considered to be structures,

consequently, they are not within the scope of this document. Chemical agent and nuclear contaminants (except for radon) are also not within the scope of this document. The term "process contaminant" refers to any organic or inorganic contaminant that may be present in a BRAC structure as a result of facility or mission operations (e.g., pesticide formulation/storage, plating operations).

2.0 STATUTORY/REGULATORY REQUIREMENTS AND U.S. ARMY POLICY GUIDANCE

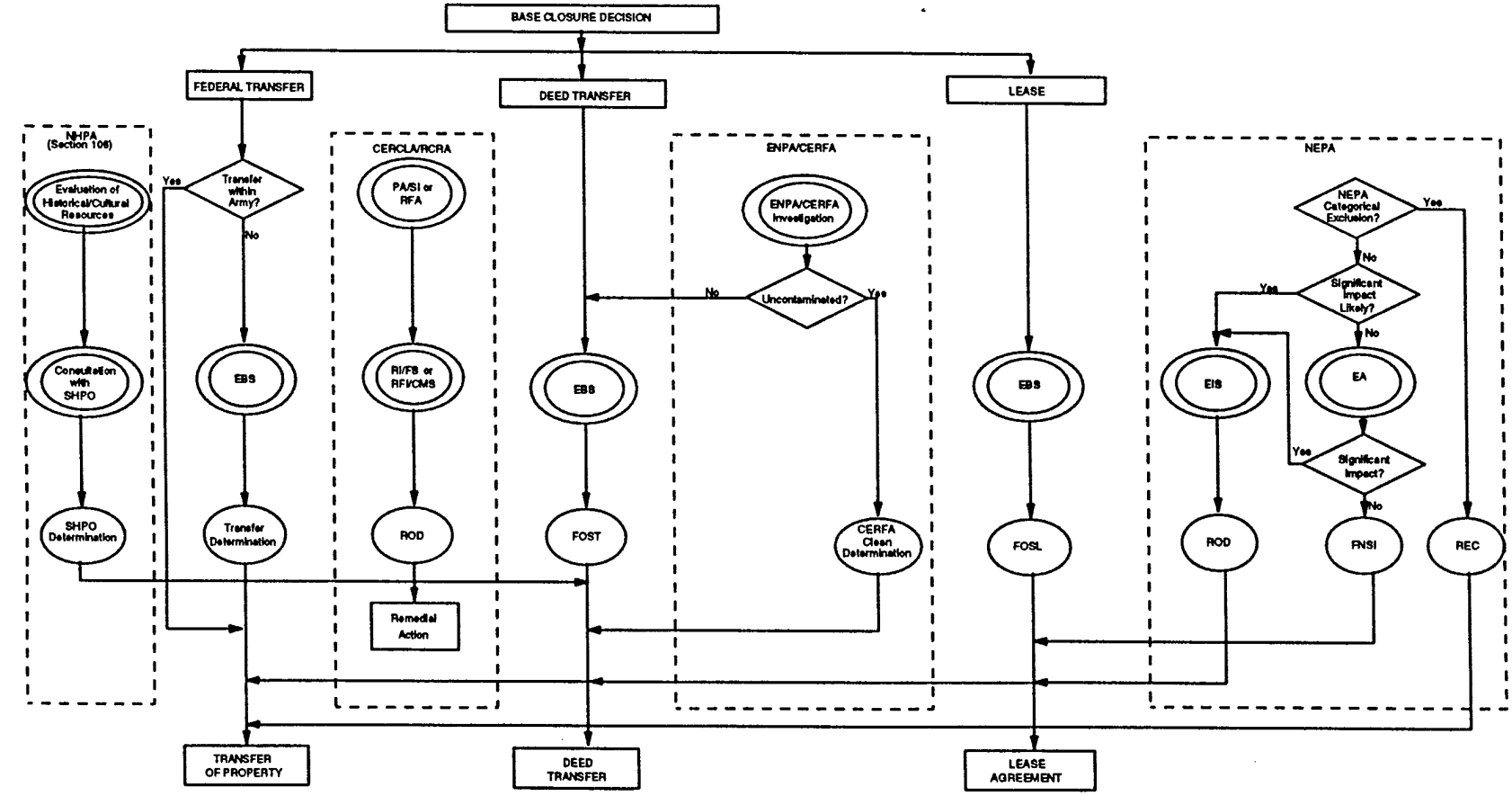
The management of the U.S. Army (Army) structures and their investigations during the base closure process is largely dependent on the requirements of pertinent environmental and real property transfer statutes and regulations. Further guidance and requirements are contained within U.S. Environmental Protection Agency (EPA) and Army policy guidance documents. State and local requirements, which may be more stringent than their Federal counterparts, must also be considered. This section provides a summary of these requirements focusing on the five categories of contaminants examined in the SPMP.

2.1 REQUIREMENTS FOR ENVIRONMENTAL INVESTIGATIONS

The most general mandate is the statutory requirement of the National Environmental Policy Act (NEPA). NEPA has been adopted and required actions have been defined by Army Regulation (AR) 200-2, which requires that proponents of Federal actions that may affect the environment assess these impacts, individually and collectively. For National Priority List (NPL) sites, the environmental assessment (EA) process required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as codified by the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) 300) mirrors NEPA's requirements. This process includes the Remedial Investigation (RI), a description of environmental contamination, and Feasibility Study (FS), an evaluation of remedial options. Further, most sites undergoing remediation must comply with the closure and/or corrective action provisions of the Resource Conservation and Recovery Act (RCRA). The RCRA environmental assessment process parallels that of NEPA and CERCLA, and is comprised of a RCRA Facility Assessment or RCRA Facility Investigation (RFI), similar to the CERCLA RI, and a Corrective Measures Study (CMS) or RCRA Closure Plan, similar to the CERCLA FS. Figure 2-1 portrays the environmental investigations pertinent to structures and base closure.

CERCLA identifies a number of requirements for the transfer of property by Federal agencies on which any hazardous substance was stored for 1 year or more, known to have been released, or disposed. A complete search of the agencies' files must be conducted to compile available information, including the type and quantity of the hazardous substance, the time period that storage, release, or disposal took place, and a description of any remedial action. This information must be included in the property transfer deed, along with a covenant warranting that remedial action has been taken to protect human health and the environment. Any additional remedial action found to be necessary after the property transfer will be conducted by the Army, unless the property has been transferred to a potentially responsible party.

Many base closures are accompanied by an Environmental Impact Statement (EIS), because the closures are typically considered major Federal actions significantly affecting the environment. The EISs, which lead to issuance of a Record of Decision, generally emphasize broad socioeconomic effects of closure, land use changes, and reuse options. As such, the environmental characterization of specific structures is generally not addressed in detail, although an infrastructure study is normally conducted. On the other hand, property transfers that are not predicted to have a significant impact on the environment are accompanied by a NEPA EA. If the EA concludes that significant impacts to the environment will not occur, a Finding of No Significant Impact is issued. Otherwise, a Notice of Intent is issued and an EIS is prepared. Property transfers between Federal agencies that will result in the same future



Prepared for:
U.S. Army Environmental Center

Rev: 09/20/94
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Figure 2-1
Environmental Investigations Related to Structures in Base Closure

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land use are categorically excluded from NEPA investigations. For these transfers, a NEPA Record of Environmental Consideration is prepared to document that the transfer is categorically excluded. (Typically, this situation is limited to transfers within the U.S. Department of Defense (DOD) because transfers outside of DOD are usually accompanied by a change of land use).

For BRAC properties that are partially or wholly contained within the boundaries of an NPL site and that are undergoing remediation under RCRA closure or corrective action provisions, the NEPA EIS, the CERCLA RI/FS, and the RCRA RFI/CMS investigations all may be conducted. In these situations, the EIS typically addresses socioeconomics and land use changes; the RI/FS addresses overall contamination in air, water, soil, and to a lesser extent, structures; and the RFI/CMS typically focuses on contamination within operations-specific parcels.

Army property transactions are accompanied by several further environmental investigations, as follows:

- The Community Environmental Response Facilitation Act (CERFA) requires identification and documentation of all uncontaminated real property, or parcels thereof, at installations undergoing closure or realignment. Uncontaminated property is any real property on which no hazardous substance and no petroleum products or their derivatives were stored for 1 year or more, known to have been released, or disposed of.

  A CERFA investigation determines parcels that are uncontaminated and also those that have been contaminated. Requirements for this study are based primarily on existing information, and include: 1) review of all installation, DOD, and regulatory agency records; 2) review of the recorded chain of title documents regarding the property; 3) aerial photographic analysis for prior land use; 4) visual inspections of the property and adjacent properties; 5) physical inspection of adjacent properties; 6) review of Federal, State, and local government records of adjacent properties where there has been a hazardous substance release; and 7) interviews with current or former employees involved in the property's operations. Sampling can also be conducted, if necessary. Because the CERFA statute has been adopted under CERCLA, regulatory concurrence on CERFA determinations is necessary from EPA at NPL sites and State concurrence is necessary at all other sites.

  A companion document to the CERFA investigation is the Enhanced Preliminary Assessment (ENPA), which provides much the same information as the CERFA investigation, but also identifies areas requiring environmental evaluation and recommended actions for these areas. The term "enhanced" is used to distinguish these assessments from the previous Army Installation Restoration Program (IRP) preliminary assessments (PAs), because the BRAC ENPAs are conducted from a property transfer perspective, and evaluate areas which are not typically included in the IRP (e.g., asbestos, radon, PCBs, etc.). The ENPA is required by Army policy guidance, not by statute. It should be noted that the Army's ENPA is not intended to conform or meet the objectives of current EPA guidance for the preparation of PAs under CERCLA.

- For actions to lease or for deed transfer of Army real property outside of Federal government control, DOD guidance requires that an Environmental Baseline Survey (EBS) be performed to assess the suitability of the property for leasing or transfer. The assessment is required to determine the environmental condition of the property and is used as a basis for the Finding of Suitability for Lease (FOSL) or Finding of Suitability for Transfer (FOST).

  A FOST or FOSL may be issued based on findings that either 1) no hazardous substance was stored for 1 year or more, is known to have been released, or was disposed of on the parcel; or 2) storage of greater than 1 year, release, or disposal took place but the property is not now contaminated (Hill, 1994a). Additionally, a FOSL may also be issued if some level of contamination exists but the property can be used pursuant to a proposed lease with acceptable risk to human health and the environment.

  The requirements for the FOSTs, FOSLs, and associated EBS investigations are not statutory, but rather are DOD guidance mandates. Accordingly, involvement of Federal and State regulatory agencies is one of consultation rather than concurrence.

- Under AR 200-1, transfer of Army real property to a non-Army Federal entity requires an EBS. Previously, a preliminary assessment screening (or PAS) was conducted, however, these are now obsolete (Hill, 1994b). As part of the EBS, the Army is required to develop information to assess health and safety risks, define the extent of environmental contamination, and identify potential liabilities involved with real property transfers/disposal.

  The EBS can be attached to the real property transaction if the findings indicate that no hazardous substance storage, release, or disposal took place. Otherwise, the Army must carry out the Defense Environmental Restoration Program (DERP) procedures of AR 200-1 or elect to exclude the parcel from a real property transaction.

Documents summarizing the results of the above environmental investigations are required to be attached to supporting NEPA documents. It is important to note that recent DOD guidance designed to accelerate the NEPA process for base disposal decisions recognizes the overlap of the above studies. The guidance emphasizes the need to integrate these data gathering and analysis efforts with NEPA documents and community re-use plans so that timely decisions can occur. Accordingly, DOD's latest guidance is to combine early data gathering efforts related to required NEPA and real property investigations into a single effort.

DOD guidance in the area of environmental investigations related to BRAC structures is dynamic and rapidly changing. The current trend is toward integration of some of the separate requirements to provide for a more consolidated process. It is anticipated that DOD policy will continue to be updated in the future to meet changing needs or to provide further clarification of existing guidance.

2.2 SPECIFIC PROPERTY TRANSFER REQUIREMENTS

Transfers of Federal properties containing contaminants are subject to a variety of Federal regulations ranging from requirements for notification of prospective buyers when spills of reportable quantities of hazardous substances have occurred (40 CFR 373) to requirements for treatment of defective lead-based paint surfaces in residential housing (24 CFR 35 Subpart E). Transfer or leasing of Army property is subject to requirements of AR 200-1, AR 405-80, and AR 405-90, which collectively establish environmental assessment and other requirements related to transfer/leasing of real property. Further requirements for properties involved in base closure are contained within various Army policy guidance memoranda related to asbestos, radon, PCBs, and lead-based paint. In general, Army policy documents direct installation commanders to comply with all applicable Federal, State, and local requirements, and also may provide Army interpretation of these requirements in the form of procedural guidance on environmental investigations and mitigating actions.

2.3 ASBESTOS

Table 2-1 outlines the pertinent regulations, Army policy guidance, and other requirements for addressing ACM by major activity or issue involved in base closure. Base environmental coordinators should consult the details of the regulations. Collectively, the requirements include the following: 1) detailed surveys of structures prior to sale; 2) removal of most friable asbestos prior to substantive renovation or demolition; 3) ACM removal where friable asbestos presents a threat, where the future use is for schools or child care, and where the property is unsalable or removal prior to sale is cost effective; and 4) environmental evaluation if fugitive air emissions are possible (Table 2-1). The regulations also address specific requirements applicable if ACM abatement is undertaken.

2.4 RADON

Table 2-2 outlines the pertinent regulations, Army policy guidance, and other requirements for addressing radon by major activity or issue involved in base closure. The Army Radon Reduction Program required by AR 200-1 requires that radon levels be measured in all Priority 1 Army structures (i.e., day care centers, hospitals, schools, and living areas) for 90 days under worst-case conditions. If any of the Priority 1 structures have radon concentrations greater than 4 picocuries per liter (pCi/L), then long-term measurement of all Priority 2 structures (i.e., areas having 24-hour operations) and Priority 3 structures (i.e., all other routinely occupied structures) must be preformed. Additionally, long-term measurement must be conducted in Priority 1 structures which have 90-day radon measurements greater than 4 pCi/L but less than 20 pCi/L. Long-term measurements provide annual average radon levels under realistic (as opposed to worst-case) exposure conditions. The Army must mitigate structures that contain annual average radon levels of greater than 4 pCi/L, based on long-term measurement (or based on 90-day measurement if levels exceed 20 pCi/L), to less than EPA's recommended action level of 4 pCi/L. AR 200-1 provides a time table for mitigation based on radon concentrations. The only specific requirement for radon relative to base closure is that the requirement of AR 200-1 for an installation-wide radon survey is reinforced and reference is made to EPA guidance on measures to mitigate high indoor radon levels.

Table 2-1. Regulations, Army Policy/Guidance, and Other Requirements for Addressing Asbestos by Activities or Issues Involved in Base Closure.

Activity	Requirement[1]	Comments
Overall Base Closure	Army Policy Guidance (November 5, 1993)	ACM removal is necessary if: 1) friable asbestos presents a health or environmental threat; nonfriable ACM or encapsulated friable ACM need not be removed; 2) future use is for school or child care; 3) property is unsalable or removal prior to sale is cost effective; or 4) the property will be demolished.
Army Property Transfer	AR 200-1 AR 405-80 AR 405-90	Detailed survey of structures is required prior to excessing of Army property. Certification is required that most friable asbestos contamination has been cleaned up, removed, or covered.
Federal Property Transfer	40 CFR 373	Release of friable asbestos of more than 1 kg requires that disclosure occur in sale contracts for Federal property.[2]
Real Property Sales	Local Disclosure Rules	Contact local authorities
Schools	40 CFR 763 Subpart E (AHERA Regulations) AR 200-1	By AR 200-1, the Army adopted AHERA; response actions necessary if friable asbestos is damaged or has potential for damage; removal is not required.
Renovation	40 CFR 61 Subpart M (CAA Regulations) (NESHAPs)	Most friable ACM is required to be removed before renovation; notification procedures are outlined; for jobs with < 260 linear ft or < 160 ft^2 of friable asbestos, removal and notification are not required. Jobs may not be segmented or divided into small increments to avoid the regulatory requirements.
Demolition	40 CFR 61 Subpart M	Most friable ACM to be removed before demolition; notification procedures are required; for jobs with < 260 linear ft or < 160 ft^2 of friable asbestos, removal is not required but notification is required. Jobs may not be segmented or divided into small increments to avoid the regulatory requirements.

> Greater than
< Less than

1 In addition to the regulations and policies cited below, two EPA guidance documents should be reviewed: 1) Guidance for Controlling Asbestos in Buildings (EPA, 1985a); and 2) Managing Asbestos in Place (EPA, 1990a).

2 However, per Army guidance dated November 5, 1993, asbestos incorporated into a building as part of the structure has not been "stored" or "disposed of" (or, by extension, released) in the meaning of the NCP.

ACM Asbestos Containing Material (> 1 percent asbestos by weight - Federal definition. State definition may differ as noted by California designation of ACM as > 0.1 percent by weight)
AHERA Asbestos Hazard Emergency Response Act
AR Army Regulation
Army U.S. Army
CAA Clean Air Act
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
ft foot or feet
ft^2 square foot or square feet
kg kilogram(s)
NCP National Contingency Plan
NESHAP National Emissions Standards for Hazardous Air Pollutants
PEL Permissible Exposure Limit

Table 2-1. Regulations, Army Policy/Guidance, and Other Requirements for Addressing Asbestos by Activities or Issues Involved in Base Closure.

Activity	Requirement[1]	Comments
Disposal of Debris	40 CFR 61 Subpart M 49 CFR 177 Army Policy Guidance (November 5, 1993)	All ACM removed must be disposed at active disposal sites or at facilities that convert ACM to asbestos-free material.
Worker Safety	40 CFR 763 Subpart G 29 CFR 1926 29 CFR 1910 Local Requirements[1]	Exceedance of action levels requires medical actions for workers; exceedance of PELs requires use of respirators, protective clothing, regulated areas, postings, and engineering controls.
Air emissions	40 CFR 61 Subpart M AR 200-1 AR 200-2 Local Requirements	For removal and disposal of ACM, the requirement is for no visible air emissions. Actions with potential for other fugitive emissions must be evaluated under AR 200-2. Also note that there may be local requirements related to the control of dust and similar particulate emissions during construction, renovation, or demolition activities.

> Greater than
< Less than

1 In addition to the regulations and policies cited below, two EPA guidance documents should be reviewed: 1) Guidance for Controlling Asbestos in Buildings (EPA, 1985a); and 2) Managing Asbestos in Place (EPA, 1990a).

2 However, per Army guidance dated November 5, 1993, asbestos incorporated into a building as part of the structure has not been "stored" or "disposed of" (or, by extension, released) in the meaning of the NCP.

ACM Asbestos Containing Material (> 1 percent asbestos by weight - Federal definition. State definition may differ as noted by California designation of ACM as > 0.1 percent by weight)
AHERA Asbestos Hazard Emergency Response Act
AR Army Regulation
Army U.S. Army
CAA Clean Air Act
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
ft foot or feet
ft^2 square foot or square feet
kg kilogram(s)
NCP National Contingency Plan
NESHAP National Emissions Standards for Hazardous Air Pollutants
PEL Permissible Exposure Limit

Table 2-2. Regulations, Army Policy/Guidance, and Other Requirements for Addressing Radon by Activities or Issues Involved in Base Closure.

Activity	Requirement	Comment
Overall Base Closure	USAEC Policy Fact Sheet (July 22, 1993)	ARRP requirements are reinforced. Reference is made to EPA guidance documents.[1]
ARRP	AR 200-1	The ARRP requires inventory of structures by the end of FY 1991, and mitigation of all structures with annual average radon levels >4 pCi/L based on long-term measurements (or based on 90-day measurements if levels exceed 20 pCi/L)[2] . Annual reports to MACOM on compliance with ARRP are required.
Federal Property Transfer	None	Notification provisions of 40 CFR 373 are not required due to NCP exclusion of radon from listed hazardous waste.
Army Property Transfer	AR 405-80 AR 405-90	The Army will take actions necessary to protect public health, welfare, and the environment.
Real Property Sales	Local Disclosure Rules	Contact local authorities

> Greater than

1 EPA, 1986a; EPA, 1988

2 The 4 pCi/L action level is not associated with a Federal ambient air standard, but corresponds to EPA guidance that structures with indoor ambient air with radon levels greater than 4 pCi/L should be mitigated.

AR Army Regulation
Army U.S. Army
ARRP Army Radon Reduction Program
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
FY Fiscal Year
MACOM Major Command
NCP National Contingency Plan
pCi/L picocuries per liter
USAEC U.S. Army Environmental Center

2.5 POLYCHLORINATED BIPHENYLS

Table 2-3 outlines the pertinent regulations, Army policy guidance, and other requirements for addressing PCBs by major activity or issue involved in base closure. AR 200-1 adopts the implementing regulations for the Toxic Substances Control Act (TSCA) that control actions taken with respect to electrical equipment and contained PCBs. Notably, the TSCA regulations (40 CFR 761) also specify clean-up levels for PCB spills within structures. Army base closure policy guidance requires that: 1) PCBs be considered in the RI/FS process; 2) the base PCB inventory be used in the PCB study; and 3) EPA sampling guidance (EPA, 1985b; EPA, 1990b) be used.

2.6 LEAD-BASED PAINT

Table 2-4 outlines the pertinent regulations, Army policy guidance, and other requirements for addressing lead-based paint by major activity or issue involved in base closure. For base closures prior to 1995, all structures intended for post-sale residential habitation which were constructed prior to 1978 must be inspected for lead-based paint hazards. The lead-based paint hazards identified must then be eliminated by treatment or removal of defective lead-based paint. Purchasers must be notified of any hazards. For base closure executed after 1994, the provisions of Public Law 102-550 apply, namely the following: 1) for pre-1960 target housing (Army housing used or intended to be used as residence for children under 6 years of age), inspection and abatement of all lead-based paint (intact or not) and lead-containing dust that are accessible for children to mouth/chew; and 2) for post-1960 target housing, inspection and notification of lead-based paint hazards to purchasers is required, while abatement is not.

For characterization of whole-building demolition debris with lead-based paint, Army policy guidance states that composite samples of entire buildings are acceptable and typically demonstrate that the demolition waste stream is not a characteristic hazardous waste under the RCRA. If demolition debris is treated, the residuals resulting from treatment of surfaces with lead-based paint may exhibit the toxicity characteristic for lead, though the debris itself would likely not be a hazardous waste. Lead-based paint residues generated by renovation and maintenance projects (e.g., removal of old paint prior to repainting during renovation) will likely exhibit the toxicity characteristic for lead and thus require separate management and disposal.

2.7 HISTORICAL AND CULTURAL RESOURCES

Table 2-5 outlines the pertinent statutes, regulations, Army policy guidance, and other requirements for addressing historical and cultural resources. The Army (AR 420-40 and 200-1) requires compliance with the National Historic Preservation Act, NEPA, and other Federal, State, and local requirements related to historical/cultural resources. Generally, structures older than 50 years having historical "significance" should be evaluated for nomination for the National Register of Historic Places. Inventories of historical/cultural resources are required as is a Cultural Resources Management Plan. Consultation with the State Historic Preservation Officer (SHPO) is a key factor in compliance with cultural resource requirements; often, this consultation is accomplished as part of the NEPA process. Assessment of the effects of all Army actions on historical and cultural resources is required and is expected to be addressed in the base closure EIS. However, USAEC policy guidance (USAEC, 1993a) suggests that the interrelationship between cultural resources and environmental issues also may be addressed within the RI/FS process for facilities where remediation may be required.

Table 2-3. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing PCBs by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comment
Overall Base Closure	USAEC Fact Sheet (September 30, 1993)	PCB contamination should be considered in base closure: sampling plans should use the base PCB inventory and follow EPA guidance in performing the PCB study. Equipment surfaces should be considered for remediation.
	EPA Guidance[1] on PCBs	EPA guidance outlines sampling strategies, suggested sample locations, and guidelines for results interpretation, including strategies for use within structures.
Army Property Transfer	AR 200-1 AR 405-80 AR 405-90	ARs adopt 40 CFR 761, including the requirement for a PCB certification executed by the installation commander.
Federal Property Transfer	40 CFR 373	Release of PCBs at more than 1 kg requires that disclosure occur in sale contracts for Federal property.
Real Property Sales	Local Disclosure Rules	Contact local authorities
PCB Use, Storage, Disposal	40 CFR 761	Comprehensive rules on PCBs allow that PCB transformers in service can stay in service; if taken out of service, they can be stored at a licensed storage facility for up to 1 year, then fluids must be incinerated at an incinerator that meets TSCA requirements, and equipment disposed at licensed landfill. TSCA PCB incinerators must achieve removal efficiencies of 99.9999 percent DRE ("six 9s") for PCBs.
	(TSCA Regulations)	RCRA rules state that liquid hazardous waste containing PCBs >500 ppm must be incinerated and PCBs >50 but <500 ppm must be incinerated or high efficiency boiler-burned. RCRA hazardous waste incinerators must achieve removal efficiencies of 99.99 percent ("four 9s") for POCs.

> Greater than
< Less than

1 EPA, 1985a; EPA, 1990b

AR Army Regulation
Army U.S. Army
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
cm^2 square centimeter(s)
DRE Destruction and Removal Efficiency
EPA U.S. Environmental Protection Agency
HOC Halogenated Organic Compound
kg kilogram(s)
LDR Land Disposal Restriction
PCB Polychlorinated biphenyl
POC Principal Organic Constituent
ppm parts per million
RCRA Resource Conservation and Recovery Act
TSCA Toxic Substances Control Act
µg microgram(s)
USAEC U.S. Army Environmental Center

Table 2-3. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing PCBs by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comment
PCB Use, Storage, Disposal (Continued)	40 CFR 268 (RCRA LDRs)	RCRA-hazardous waste with total HOCs >1000 ppm must be incinerated, but special considerations apply to wastes generated during CERCLA remediation process, and RCRA debris, including debris generated from the demolition of structures.
	State/Local Regulations	State/local rules may regulate more stringently, with permits, manifesting, and analysis required for all PCB equipment; and by imposing different storage, labeling, and disposal requirements.
Recordkeeping	40 CFR 761 AR 200-1	Recordkeeping is required to be most stringent for installations that have >45 kg of PCBs in containers, one or more PCB transformers, and 50 or more PCB capacitors. AR 200-1 requires that the records required by 40 CFR 761 form the basis of an annual PCB inventory document.
Spills	CERCLA Section 313 40 CFR 372 40 CFR 761	Notification procedures are outlined for spills of hazardous substances over reportable quantities (CERCLA Section 313; 40 CFR 372). TSCA regulations require clean-up levels of 10 ug/100cm^2 and 100 ug/100cm^2 in structures, depending on type of spill and structure.

> Greater than
< Less than

1 EPA, 1985a; EPA, 1990b

AR Army Regulation
Army U.S. Army
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
cm^2 square centimeter(s)
DRE Destruction and Removal Efficiency
EPA U.S. Environmental Protection Agency
HOC Halogenated Organic Compound
kg kilogram(s)
LDR Land Disposal Restriction
PCB Polychlorinated biphenyl
POC Principal Organic Constituent
ppm parts per million
RCRA Resource Conservation and Recovery Act
TSCA Toxic Substances Control Act
µg microgram(s)
USAEC U.S. Army Environmental Center

Table 2-4. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing Lead-Based Paint by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comment
Overall Base Closure (executed after 1994)	Residential Lead-Based Paint Hazard Reduction Act of 1992	Army policy guidance (November 5, 1993) adopts provisions of PL 102-550: 1) for pre-1960 housing, inspection and abatement of all lead-based paint hazards which include lead-based paint (intact or not) and dust accessible for children to mouth/chew and removal or covering of lead-contaminated soil; and 2) for post-1960 housing, inspection and notification of presence of lead-based paint/hazards to prospective purchasers (abatement not required). These provisions apply to disposition of Army housing used or intended for use as residence for children under 6 years of age.
Overall Base Closure (executed prior to 1995)	Army Policy Guidance (November 5, 1993)	Regulations at 24 CFR 35 (Subpart E) are adopted for base closure and apply to properties intended for residential habitation (except as noted below). Army will ensure that properties for sale or lease are free from lead-based paint hazards. If sale/lease occurs before such hazards are identified or treated, the transaction will prevent use of property for residence until any hazards are treated. All painted surfaces on structures built prior to 1978 must be inspected per AEHSC Technical Note[1]; sampling of paint, dust, and soil is not required.
Sale of Federal Property	24 CFR 35 (Subpart E)	Prior to sale where property is intended for use as a residence, Federal agencies must inspect all structures constructed before 1978; treatment to eliminate lead-based paint hazards include covering or removal; washing/repainting is not adequate; purchasers must be notified of hazards.
Army Property Transfer	AR 200-1 AR 405-80 AR 405-90	The Army will take all actions necessary to protect public health, welfare, and the environment.
Real Property Sales	Local Disclosure Rules	Contact local authorities
In Place Management	Army Policy Guidance (April 28, 1993)	Between the time of inspection and sale/leasing for all residential Army property, assumed lead-based paint surfaces should be monitored and dust should be cleaned if lead build-up is suspected. Procedures in maintenance/repair work should consider potential to disturb lead-based paint.
Clean-up Procedures	Army Policy Guidance (April 28, 1993)	Strategies for inspecting samples of structures (rather than all structures) are outlined as are recommended surface testing sites, clean-up procedures, and disposal practices.

1 AEHSC, 1991
2 AEHA, Undated

AEHA U.S. Army Environmental Hygiene Agency
AEHSC U.S. Army Engineering and Housing Support Center
AR Army Regulation
Army U.S. Army
BDAT Best Demonstrated Available Technology
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
LDR Land Disposal Restriction
PL Public Law
RCRA Resource Conservation and Recovery Act

Table 2-4. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing Lead-Based Paint by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comment
Demolition	Army Policy Guidance (April 28, 1993) AEHA Sampling Protocol[2] 40 CFR 261 (RCRA Hazardous Wastes) 40 CFR 268 (Debris Rule and LDRs)	Army policy guidance adopts the AEHA Sampling Protocol for characterization of demolition debris for buildings with lead-based paint. The AEHA sampling protocol, verbally approved by EPA, states that, for whole building demolition, composite samples of a sample of whole buildings suffices and shows that the debris is typically nonhazardous waste. Residuals generated by treatment of lead-based painted surfaces (including application of Debris Rule BDAT) or by renovation or maintenance must be segregated as a separate waste stream, is likely hazardous per RCRA regulations, and must be separately managed and disposed.

1 AEHSC, 1991
2 AEHA, Undated

AEHA U.S. Army Environmental Hygiene Agency
AEHSC U.S. Army Engineering and Housing Support Center
AR Army Regulation
Army U.S. Army
BDAT Best Demonstrated Available Technology
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
LDR Land Disposal Restriction
PL Public Law
RCRA Resource Conservation and Recovery Act

Table 2-5. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing Historical and Cultural Resources by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comments
Overall Base Closure	USAEC Fact Sheet (September 9, 1993)	Effects of site transfer actions on cultural resources are usually evaluated in the base closure EIS; however, these EISs are primarily concerned with overall effects of land transfer. Integrating the Cultural Resources Survey into the RI/FS process should be done to consider the inter-related factors of human health risks and cultural resource protection. Effects of remediation on cultural resources should also be considered.
Federal Actions	NHPA (implemented by 36 CFR 60, 63, and 800)	The NHPA provides requirements and guidance on identifying and protecting historically and culturally important sites including structures. Generally, structures older than 50 years or having historical "significance" should be considered for protection. The NHPA provides for the National Register of Historic Places and requires Federal agency consultation with the State Historic Preservation Officer and evaluation of actions on historically significant sites. The NHPA also assigns Federal agencies the responsibility for the preservation of their historic properties, as appropriate, and requires Federal agencies to assess alternative uses for historic properties which do not affect their significant characteristics. The NHPA does not, however, require Federal agencies to preserve historic properties.
	NEPA (implemented by 40 CFR 1500)	The NEPA requires Federal agencies to assess the environmental effects of their actions including effects on both natural and cultural environments as well as a Cultural Resources Management Plan.
Army Actions	AR 200-1	AR 200-1 requires compliance with State/local requirements, including designation and protection of State historic sites.
	AR 200-2	AR 200-2 implements the requirements of NEPA for Army actions.
	AR 420-40	AR 420-40 establishes the Army's goals to protect structures of historical or cultural value in compliance with NHPA, NEPA, and other statutes. Inventories of cultural/historical sites are required as is a Cultural Resources Management Plan.
Cold War Objects/Sites	National Register Bulletin 22[1]	Cold war objects and sites may qualify as sites considered for protection, though they are less than 50 years old (the "rule of thumb" for determining historic significance). The Bulletin lists factors to consider when deciding whether a site has historical significance, including measures of exceptional or unusual contributions to American history or culture.

1 National Park Service, 1993

AR Army Regulation
Army U.S. Army
CFR Code of Federal Regulations
EIS Environmental Impact Statement
FS Feasibility Study
NEPA National Environmental Policy Act
NHPA National Historic Preservation Act
RI Remedial Investigation
USAEC U.S. Army Environmental Center

Effects of remediation on historically or culturally significant structures should be considered during the RI/FS process.

The parameters or characteristics that may cause a site or location to be considered of historic importance change over time. For example, currently, particular attention should be given to base closure actions which could affect Cold War object/sites, because of a recent focus on this theme. Recent guidance from the U.S. Department of Interior (National Park Service, 1993) cautions that nomination of sites less than 50 years old is appropriate only if they are of exceptional or unique significance.

2.8 PROCESS CONTAMINANTS

Table 2-6 outlines the pertinent regulations, Army policy guidance, and other requirements for addressing process contaminants. Structures that have contained process equipment or have housed process-related activities may require assessment to determine whether remediation is required. Overall guidance for remediation studies and activities is provided by either CERCLA and its regulations (the NCP), RCRA, or NEPA. Compliance with Federal, State, and local laws, regulations, and ordinances is required. Depending upon the exact regulatory framework, an evaluation of remedial options and selection of an appropriate remedy, including a remedy for structures, may be required.

2.8.1 Future Use Structures

For structures that will have a future use and that contain process contaminants, occupational health standards apply. This includes structures whose future use is for preservation as an historical or cultural resource. For the purposes of this report, it is assumed that all structures that are not designated for demolition will have a future use. It is further assumed that structures formerly used for industrial or mission-oriented operations (i.e., those where process contaminants may exist), will not be subsequently used for residential purposes.

For airborne contaminants in future use buildings that were formerly used for industrial or mission-oriented operations, the standards consist of Occupational Health and Safety Administration (OSHA) regulations and National Institute of Occupational Safety and Health (NIOSH) and American Council of Government Industrial Hygienists (ACGIH) criteria that provide concentration-based contaminant-specific standards for occupational exposure to hazardous chemicals. For dust contaminants in future use buildings, there are no standards calculated for the ingestion pathway, but OSHA has established a "skin designation" for dermal exposure to hazardous contaminants in dust, specifying that skin exposure to dust containing these chemicals must be prevented.

For future use buildings that were not formerly used for industrial or other mission-oriented purposes and that will potentially be used for residential purposes, the requirements related to radon, the removal of ACM, disclosure or abatement of lead-based paint may apply (see the discussion in Sections 2.3, 2.4, and 2.6, above). If such structures are near industrial buildings that are being remediated because of contamination, the occupational exposure limits discussed above may apply to any workers who clean or renovate the adjacent uncontaminated buildings.

Health-based criteria for use as guidelines for dust contaminants in future use buildings are outlined in Section 4.4.5.

Table 2-6. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing Process Contaminants by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comment
Army Property Transfer	AR 405-80 AR 405-90	The Army may transfer property without decontamination, or may decontaminate to a restricted or unrestricted use. Decontamination may not occur if associated costs are higher than returns to be gained in property disposal. However, public health, welfare, and the environment will be protected.
Occupational Health (Air Contaminants)	29 CFR 1910 OSHA Regulations	OSHA regulations provide concentration-based, contaminant-specific standards for occupational exposure to hazardous airborne contaminants. Measures are included to reduce concentrations or minimize exposure pathways.
	NIOSH/ACGIH Criteria	NIOSH/ACGIH criteria are not regulations, but are widely used in industrial settings as guidelines for worker exposure to airborne hazardous contaminants.
Occupational Health (Dust Contaminants)	None for Ingestion 29 CFR 1910 (for Dermal Exposure)	OSHA established a "skin designation" for hazardous contaminants specifying that skin exposure must be prevented or reduced through certain practices (e.g., gloves, work practices). Allowable concentration standards are not given.
NPL Remediation	CERCLA	CERCLA requires that all remedial actions at NPL sites, including those at Federal facilities, must comply with Federal standards/criteria (or more stringent State requirements) determined to be ARARs.
	NCP	Per the NCP, ARARs are developed within the context of the FS process, which evaluates various alternatives for remediation, including remedial actions for structures.
Hazardous Waste Determination	RCRA 40 CFR 261 40 CFR 268 State RCRA-Equivalent Hazardous Waste Rules (check local authorities)	RCRA hazardous waste requirements may apply to structures intended to be "discarded", if demolition debris or treatment residuals will contain a listed or characteristic hazardous waste. Stringent sampling, treatment, and disposal requirements may apply. However, for material classified as "debris" (40 CFR 268), performance-based rather than concentration-based treatment options are allowed with less stringent sampling and disposal requirements.
Remediation Waste Management	40 CFR 264, 268 (CAMU Rule)	Debris generated during structures remediation that contains listed or characteristic hazardous waste may be managed and "placed" on a facility without triggering the RCRA LDRs, potentially allowing for less stringent sampling, treatment, and disposal requirements.

ACGIH	American Council of Government Industrial Hygienists
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
Army	U.S. Army
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
FS	Feasibility Study
LDR	Land Disposal Restriction
NCP	National Contingency Plan
NIOSH	National Institute of Occupational Safety and Health
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act
USAMC	U.S. Army Materiel Command

Table 2-6. **Regulations, Army Policy/Guidance, and Other Requirements for Addressing Process Contaminants by Activities or Issues Involved in Base Closure.**

Activity	Requirement	Comment
Chemical Agent	USAMC Regulation 385-131	The regulation includes procedures for handling equipment and for decontamination and disposal of materials from structures with a history of chemical agent use.
Nuclear Decommissioning	10 CFR Various Parts (NRC Regulations)	Base closure at Army facilities where nuclear materials have been used (e.g., hospitals, health research centers) may be subject to NRC license decommissioning regulations.

ACGIH American Council of Government Industrial Hygienists
AR Army Regulation
ARAR Applicable or Relevant and Appropriate Requirement
Army U.S. Army
CAMU Corrective Action Management Unit
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
FS Feasibility Study
LDR Land Disposal Restriction
NCP National Contingency Plan
NIOSH National Institute of Occupational Safety and Health
NPL National Priorities List
NRC Nuclear Regulatory Commission
OSHA Occupational Safety and Health Administration
RCRA Resource Conservation and Recovery Act
USAMC U.S. Army Materiel Command

2.8.2 No Future Use Structures

It is assumed that the likely fate of structures with no designated future use is demolition or treatment, or both. The existing regulatory framework for managing waste streams, including demolition debris and remediation-generated wastes, provide requirements and guidelines for sampling, treatment, and disposal methods.

2.8.2.1 RCRA Hazardous Waste Requirements

RCRA provides requirements for identification and management of solid and hazardous wastes. Management of solid and hazardous waste may be delegated under RCRA to states whose statutes and regulations are at least as stringent as Federal counterparts. Under such delegation, State requirements (including State requirements that are more stringent that Federal requirements) have primacy.

Of particular importance to the management of BRAC structures is that, to qualify for possible inclusion under the definition of RCRA hazardous waste, a material has to be first be "discarded" or "intended to be discarded" (i.e., it must first meet the definition of a solid waste). Thus, demolition debris and remediation-generated wastes may be solid or hazardous wastes as defined by RCRA. In contrast, a structure left standing is not a waste, and thus cannot be a solid or hazardous waste unless or until it is discarded or otherwise disposed of.

The two categories of hazardous waste defined under RCRA are listed hazardous wastes and characteristic hazardous wastes. Listed hazardous wastes are those specified and assigned a waste code in 40 CFR 261, and include specifically identified wastes or wastes that are generated by specific processes (e.g., pesticide manufacture wastes, spent halogenated solvents, and discarded commercial chemical products). Characteristic hazardous wastes exhibit the physical characteristic of ignitability, corrosivity, and reactivity; or exhibit the characteristic of toxicity as determined through the application of specific leaching procedures and resultant concentrations of specified constituents. If demolition or remediation debris is a RCRA listed or characteristic hazardous waste, stringent sampling, treatment, and disposal requirements may apply.

2.8.2.2 The Debris Rule

The Debris Rule (40 CFR 268) contains provisions to be considered in determining management requirements for treatment and disposal of "debris" (defined below). Further, the debris is hazardous if it meets the regulatory definitions of listed or characteristic hazardous waste. Management options for treatment, sampling, and land disposal of "debris" include the option of applying performance-based technologies rather than having to treat the debris to meet minimum technology requirements or the more stringent concentration-based standards specified in the Land Disposal Restrictions (LDRs). In addition, for debris that is categorized as hazardous, electing to treat the debris using the Debris Rule performance-based removal or destruction technology methods means that the treated debris can be disposed of as a RCRA Subtitle D solid waste, rather than as a Subtitle C hazardous waste. The debris can also be managed based upon the "contained-in" policy (i.e., the debris is subjected to the LDR treatment for the constituents contained in the debris), but the treated debris must then be disposed of as a Subtitle C hazardous waste. Residuals resulting from the treatment of the debris must be disposed of as a hazardous waste, unless they no longer exhibit a characteristic of a hazardous waste or contain no listed hazardous waste constituents.

Under the Debris Rule, "debris" is defined as: "... solid material exceeding a 60 mm particle size that is intended for disposal and that is: A manufactured object; or plant or animal matter, or natural geologic material. However, the following materials are not debris: Any material for which a specific treatment standard is provided in Subpart D, part 268; Process residuals such as smelter slag and residues from the treatment of waste, wastewater, sludges, or air emission residues; and intact containers of hazardous waste that are not ruptured and that retain at least 75% of their original volume. A mixture of debris that has not been treated to the standards provided by §268.45 and other material is subject to regulation as debris if the mixture is comprised primarily of debris, by volume, based on visual inspection (40 CFR 268.2(g))." Similarly, "hazardous debris" is defined as: " ... debris that contains a hazardous waste listed in subpart D [i.e., 40 CFR 261 Subpart D] of part 261 of this chapter, or that exhibits a characteristic of hazardous waste identified in subpart C of part 261 of this chapter [i.e., 40 CFR 261 Subpart C]."

Because of the more favorable treatment and disposal options available for debris if it meets the definition of "hazardous debris" rather than the RCRA hazardous waste definitions, the classification of structural debris should be carefully evaluated.

2.8.2.3 Remediation Wastes and Corrective Action Management Unit Requirements

Designation of Corrective Action Management Units (CAMUs) is provided for in 40 CFR 264. The CAMU is specifically designed for on-site management of remediation wastes, including structures debris, at a facility, and is an option for management of structures debris and other wastes at sites where remediation is being conducted under CERCLA or RCRA. Remediation wastes are defined as all wastes and debris that contain listed or characteristic hazardous wastes that are managed at a facility for the purpose of implementing corrective action requirements (debris generated during structures remediation falls under this definition).

Placement of remediation wastes, including treatment residuals, from anywhere at a facility into a CAMU does not constitute placement of wastes in a land disposal unit, and therefore does not trigger the RCRA LDRs, including minimum technology requirements or technology-based and concentration-based treatment standards. Thus, remediation wastes that are managed on-site may be subject to less stringent sampling and disposal requirements, dependent on approval conditions of the CAMU. It is important to note that CAMU provisions are not operative in States with a delegated RCRA hazardous waste program unless specifically adopted by the State, because the CAMU requirements are considered to be less stringent than the LDR requirements. It is also important to note that, although CAMU provisions are RCRA regulations, they may be Applicable or Relevant and Appropriate Requirements at CERCLA sites.

2.8.2.4 Other Requirements

Additional requirements exist for base closure activities relative to unique process contaminants. Specifically, requirements for handling of equipment and decontamination and disposal of materials and structures involved in chemical agent usage are contained within U.S. Army Materiel Command Regulation 385-131. Closure activities related to nuclear decommissioning are regulated by the Nuclear Regulatory Commission. Such requirements are considered to be beyond the scope of this document, and are not addressed herein.

3.0 GENERAL APPROACH

The approach adopted in preparing the SPMP was to array uniform and standardized procedures that comply with the Federal regulatory framework for environmental investigations, but that also allow for local judgement and discretion. The SPMP should be used as a tool to assist base environmental coordinators in viewing the sum total of Federal requirements for structures investigations, and in planning for the specific work elements to be conducted or contracted to comply with the requirements.

A series of flow charts have been prepared for use by base environmental coordinators. These charts, which include an overall SPMP procedures chart and individual flow charts for each of the five structures issue areas (e.g., asbestos, radon, etc.), outline the major procedures that should be considered in characterizing BRAC structures for disposal. The flow charts and contained procedures are designed for use whether the structures are relatively "clean" or whether the structures fall within an NPL site.

The procedures contained within the flow charts are advisory only; they should be strongly considered by base environmental coordinators in managing structures for disposal, because they are designed for regulatory compliance. Procedures for ACM, radon, PCBs, and lead-based paint are primarily an integration and summarization of existing regulations and DOD and Army policy guidance, augmented in a few cases where guidance has not been forthcoming. However, because there are no specific DOD or Army requirements for characterization of process contaminants, the procedures in this area have been newly developed, based in part on pilot studies at the Rocky Mountain Arsenal (RMA).

Assumptions made during the preparation of the SPMP are as follows:

- For process contaminant structures with a future use, it is assumed that the future use will be similar to the former use; i.e., there will be no residential habitation of such buildings.
- Procedures for characterizing and managing process contaminant structures assume that all stored wastes have been removed from the structures.
- The SPMP assumes that all process equipment has been removed from the structures. The procedures for managing PCBs address PCB-containing electrical equipment due to TSCA's specific criteria in this area.
- For structures undergoing demolition, the SPMP assumes that all ACM, PCBs, pipelines, and utilities will be removed from the structures prior to demolition by the Army or property recipient.
- The SPMP assumes that indoor firing ranges will be treated as follows: 1) tested to determine whether the material is hazardous under RCRA; 2) removed from the structure; and 3) disposed as hazardous or nonhazardous consistent with the results of testing.
- If air monitoring or other data indicate the presence of chemical agent, specific Army protocols and agent decontamination techniques that are not the subject of the SPMP will be employed.

4.0 PROCEDURES FOR CHARACTERIZING AND MANAGING BRAC STRUCTURES

This section outlines the components of the SPMP, and is designed to actively manage environmental investigations related to BRAC structures. Section 4.1 describes the overall approach to characterizing BRAC structures including considerations to use in integrating the various environmental investigations required for transfer or lease of the structures. Section 4.2 refers to procedures to use in assessing statutes, regulations, and policy guidance to be followed in managing BRAC structures. Section 4.3 presents procedures to be considered in conducting structures inventories and historic use assessments of BRAC structures. Section 4.4 arrays the procedures suggested for use in characterizing and managing BRAC relative to presence of asbestos, radon, PCBs, lead-based paint, and process contaminants.

4.1 OVERALL SPMP CHARACTERIZATION

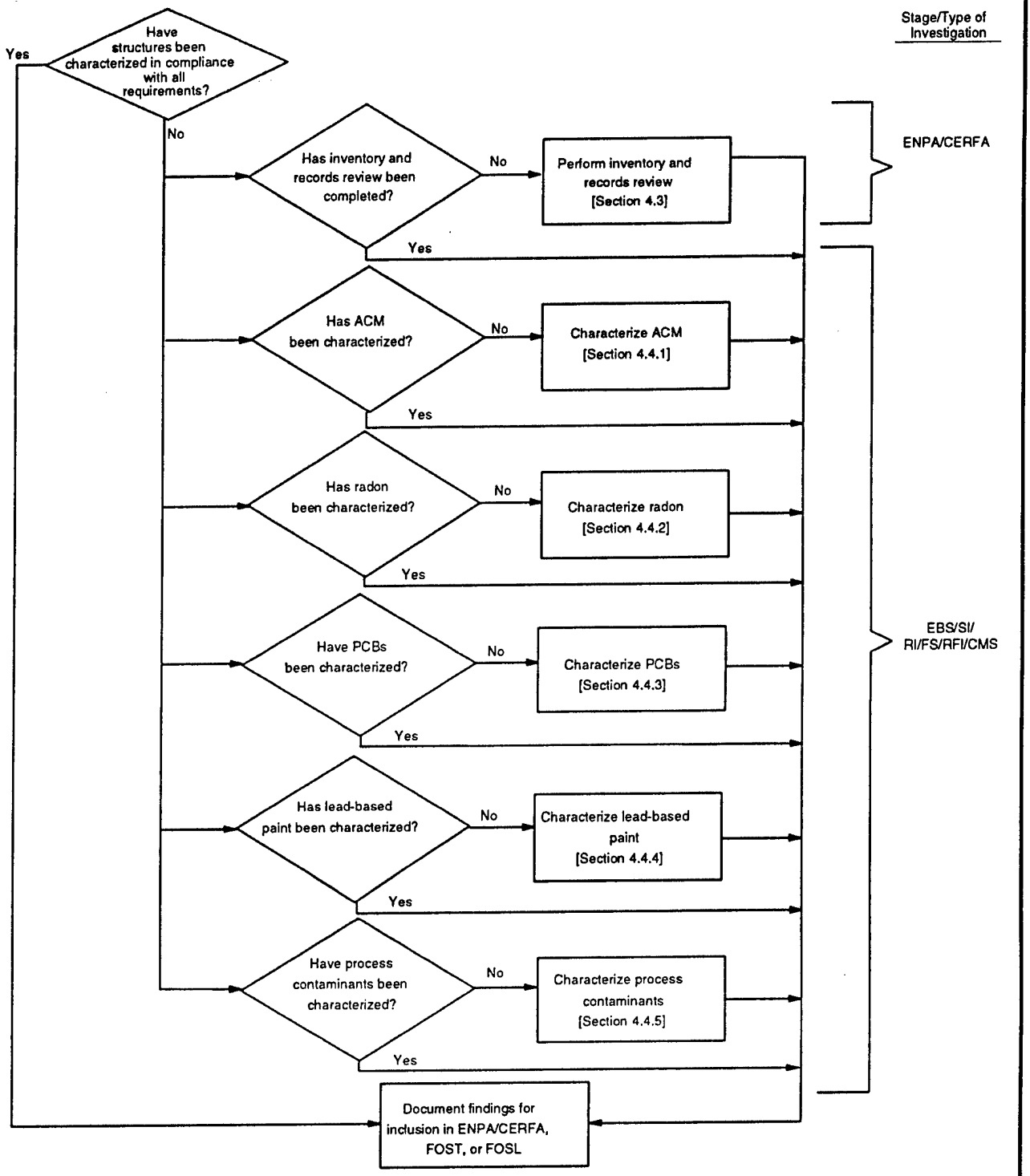
Figure 4-1 outlines the overall characterization process for structures involved in base closure. The process begins with an initial assessment, based on review of regulatory and other requirements (Tables 2-1 through 2-6), of whether all requirements for characterizing structures have been completed. If this is the case, the only further requirement is to document this characterization in the FOST or FOSL. If characterization is incomplete, the inventory and historical use assessment involved in the ENPA/CERFA process (Section 4.3) should be conducted to determine clean parcels and identify areas requiring further environmental evaluation. If all areas are determined "CERFA-clean", the only further requirement is to document this characterization in the FOST or FOSL.

If further environmental evaluation is needed, the contaminant-specific flow charts described below (Figures 4-2 through 4-15) should be consulted if these contaminants are potentially present within BRAC structures at the installation, and if they have not previously been fully characterized. These flow charts outline steps to be considered in structures evaluations during the EBS, Site Inspection (SI), RI, or FS processes.

4.1.1 Integration of Environmental Investigations

The overall SPMP process outlined above and shown in Figure 4-1 is aimed at integrating the most relevant environmental investigations conducted in characterizing structures for base closure, specifically, the ENPA, CERFA, EBS, SI, RI/FS, and RFI/CMS investigations. The procedures may be used for meeting the requirements for managing BRAC structures investigations whether the structures are primarily "clean" or significantly contaminated within an Army NPL site. For the former, only a subset of the procedures need to be followed, whereas, for the latter, the entire set of SPMP procedures may have to be followed without a duplication of effort between formerly isolated, nonintegrated investigations.

The procedures outlined for inventory and historical use assessment conducted at the ENPA/CERFA stage, described below in Section 4.3, were developed to be a sufficient base to accomplish the following: 1) characterize primarily "clean" parcels (i.e., CERFA Determinations); and 2) focus and direct the more involved characterization, sampling, and (if necessary) remedial efforts of the EBS and SI stage, without a duplication of effort. Likewise, the characterization procedures outlined for the EBS and SI stage, were developed to accomplish the following: 1) support determinations to transfer or lease (FOSTs and FOSLs); and 2) focus and support a more comprehensive sampling and remedial effort for an



ACM	Asbestos Containing Material
CERFA	Comprehensive Environmental Response Facilitation Act
CMS	Corrective Measures Study
EBS	Environmental Baseline Survey
ENPA	Enhanced Preliminary Assessment
FOSL	Finding of Suitability to Lease
FOST	Finding of Suitability to Transfer
FS	Feasibility Study
PCB	Polychlorinated biphenyl
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SI	Site Investigation

Prepared for:
U.S. Army Environmental Center

Rev: 09/20/94
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Figure 4-1
Overall Structures Program Management Plan Flow Chart

Prepared by: AGEISS Environmental, Inc.

INTERIM FINAL

RI/FS at an Army DERP or NPL site, also without a duplication of effort. If it is known at the outset of the structures characterization process that structures will need a comprehensive sampling or remedial effort requiring a complex EBS or RI/FS, the procedures may still be used in their entirety.

4.1.2 Contracting Considerations

Base environmental coordinators can utilize the overall SPMP characterization flow chart (Figure 4-1) when making decisions on appropriate entities to conduct structures investigations. For example, if it is likely that an installation will be determined substantively "clean" during the inventory and historic use assessment phase (ENPA/CERFA), then detailed sampling and environmental analysis efforts will likely not be needed, and statements of work can focus on the procedures described in Section 4.3. On the other hand, if at the outset it is likely that process contaminants exist within structures, detailed sampling and analysis may be needed and thought should be given to retaining one highly qualified contractor for the entire integrated effort; statements of work can focus on procedures contained within Section 4.4.5. Intermediate scenarios will also exist; for example, in cases where institutional knowledge points to PCBs or ACM as the primary issue, contractors with specialty competence in these areas may be sought, and statements of work can be written to address the procedures described below for these contaminants.

4.2 PROCEDURES FOR REGULATORY ASSESSMENT

After a base closure decision is made and before contracting for or starting environmental investigations of structures related to base closure, base environmental coordinators should first review Tables 2-1 through 2-6 to determine the statutes, regulations, and policy guidance requirements pertinent to managing BRAC structures for specific contaminants. While the SPMP procedures outlined in Section 4.4 of this document have been developed to comply with the primary Federal regulatory requirements, base environmental coordinators should review the tables to identify those areas where flexibility in the requirements allows for local judgement.

Local regulatory authorities should be consulted early in the regulatory assessment process to determine where local requirements are more stringent than Federal counterparts. Although certain BRAC-related decisions (e.g., FOSTs, FOSLs, and Transfer Determinations) do not require concurrence from local authorities, field experience suggests and recent DOD guidance indicates that involvement of local authorities in investigations related to these decisions in information sharing and consultation roles is advisable. Early and routine consultation with the SHPO is also advised.

It is important to note that experience gained in base closure field activities to date indicates that, in some circumstances, Federal, State, and local environmental regulations either do not apply or are vague, while local real estate sales practices and disclosure requirements are the driving forces in shaping environmental investigations and subsequent reporting activities.

4.3 GENERAL PROCEDURES FOR INVENTORY AND HISTORICAL USE ASSESSMENT

An inventory of the BRAC structures should be prepared and the historical/operational data for these structures should be compiled as part of the initial BRAC characterization process. This

information will form an operator knowledge database that will be used to assess the hazards that may potentially be present within a structure. Operator knowledge is based on existing and historical information, visual inspection of structures, employee interviews, and, in some cases, sampling data. If installation-wide surveys have not been conducted for asbestos, radon, PCBs, or lead-based paint or if individual BRAC structures have not been included in such surveys, then operator knowledge can be used to determine whether potential hazards may exist. Additionally, operator knowledge can be used to identify target process contaminants that may require evaluation in a BRAC structure.

The inventory and historical use assessment procedures described below are essentially equivalent to those used in the ENPA/CERFA investigations. Because the ENPA/CERFA studies are highly inter-related and should be accomplished using the same procedures, consideration should be given to integrating the two studies into a single investigation.

4.3.1 Inventory

An inventory that includes general descriptive information regarding the identification, construction, and use of each BRAC structure should be prepared. Additionally, any installation-wide hazard surveys, inventories, or assessments should be identified and obtained for review. This type of information should be compiled as soon as an installation is identified for closure, since many times files are archived or moved during realignment activities and are then difficult to locate.

4.3.1.1 General Procedures

A list should be prepared which identifies those BRAC structures that will be disposed by sale, lease, or demolition at each particular installation. The list should include the following types of data for each BRAC structure:

- Structure identification number (present and previous if different)
- Structure name or description (present and previous if different)
- Year constructed
- Year(s) remodeled
- Structure use (present and previous if different)
- Structure location
- Number of levels in structure
- Type of construction

Data should be summarized using the general format described in the BRAC Cleanup Plan (DOD, 1993).

4.3.1.2 Special Considerations

Installations are required by AR to conduct installation-wide surveys, inspections, and/or assessments for asbestos, radon, PCBs, and lead-based paint hazards in Army structures. Documentation of these activities are mandatory, and often include data compilation in a computer database. Copies of reports and computer database printouts should be obtained for review.

4.3.2 Historical Use Assessment

The present and past use of a BRAC structure must be assessed to determine the types of hazards that may potentially be present within a structure. Historic use information may be obtained through record review or interviews. Long-term employees should be identified and relevant information should be compiled as soon as an installation is identified for closure, so that this information is not lost during realignment or closure activities. Historical use information should be compiled for each BRAC structure, including historical use information, assessment of potential hazards, and recommendation for collection of supplemental information (e.g., sampling data, visual inspection, etc.) that may be necessary to complete the assessment. Data should be summarized using the general format described in the BRAC Cleanup Plan (DOD, 1993).

4.3.2.1 Historical Use Records

Inventory records should be reviewed to determine the types of materials that were used, stored, or transferred in the BRAC structures (e.g., general and hazardous materials inventories). Procurement records can be particularly useful in identifying types of materials and chemicals used. Hazardous waste manifest summaries should be reviewed to obtain information regarding the generation and disposal of hazardous wastes at the installation. These summaries provide information regarding type, quantity, and location at which the hazardous wastes were generated. Process information should be reviewed to identify component chemicals that were used in any manufacturing or production activities, as well as any by-products or products that may have been produced. Historical maps and aerial photographs should also be reviewed to determine possible areas of past use, storage, treatment, and disposal of potentially toxic and hazardous materials within or in close proximity to BRAC parcels.

4.3.2.2 Installation, U.S. Department of Defense, Regulatory Agency Records

All available reports relating to ongoing or completed CERCLA and RCRA investigations should be reviewed, as well as other environmental reports prepared for a particular installation. The installation's spill report files should also be reviewed to identify any spills which may have occurred within or in close proximity to BRAC structures. Federal, State, and local regulatory agency records should be reviewed to obtain information regarding present and historical operations, permits, consent decrees, memoranda of understanding or agreement, injunctions, restraining orders, violations, etc. Federal regulatory review should include EPA CERCLA and RCRA office files, the EPA Comprehensive Environmental Response, Compensation, and Liability Information System, NPL, Emergency Response Notification System spill records, and RCRA Notifier Facility reports. State regulatory review should include the State's CERCLA and RCRA office files. Local regulatory review may include county health department, county engineering department, and/or nearby city engineering department records. Personnel at the various installation, DOD, or regulatory agency offices may be interviewed in place of reviewing the specified records.

4.3.2.3 Employee Interviews

Interviewing former or present long-term employees can provide invaluable information regarding installation activities. Employees or contractors who have long-term knowledge of operations in the identified BRAC structures or in nearby non-BRAC structures, or have

installation-wide knowledge regarding operations or environmental compliance should be identified and interviewed. Employee and contractor phone numbers and addresses should be compiled as soon as an installation is identified for realignment or closure.

4.4 PROCEDURES FOR CHARACTERIZING STRUCTURES

The following sections describe procedures to characterize and manage structures relative to the five major environmental categories of interest.

4.4.1 Asbestos

Asbestos becomes a health hazard when it degrades into microscopic fibers. It is Army policy to transfer BRAC properties in a cost-effective manner which facilitates disposal of properties while protecting human health from asbestos hazards. Although there is no requirement in public law to abate ACM before disposing of a property, it is in the Army's best interest to do so when ACM is damaged, friable, and/or accessible (ACSIM, 1993).

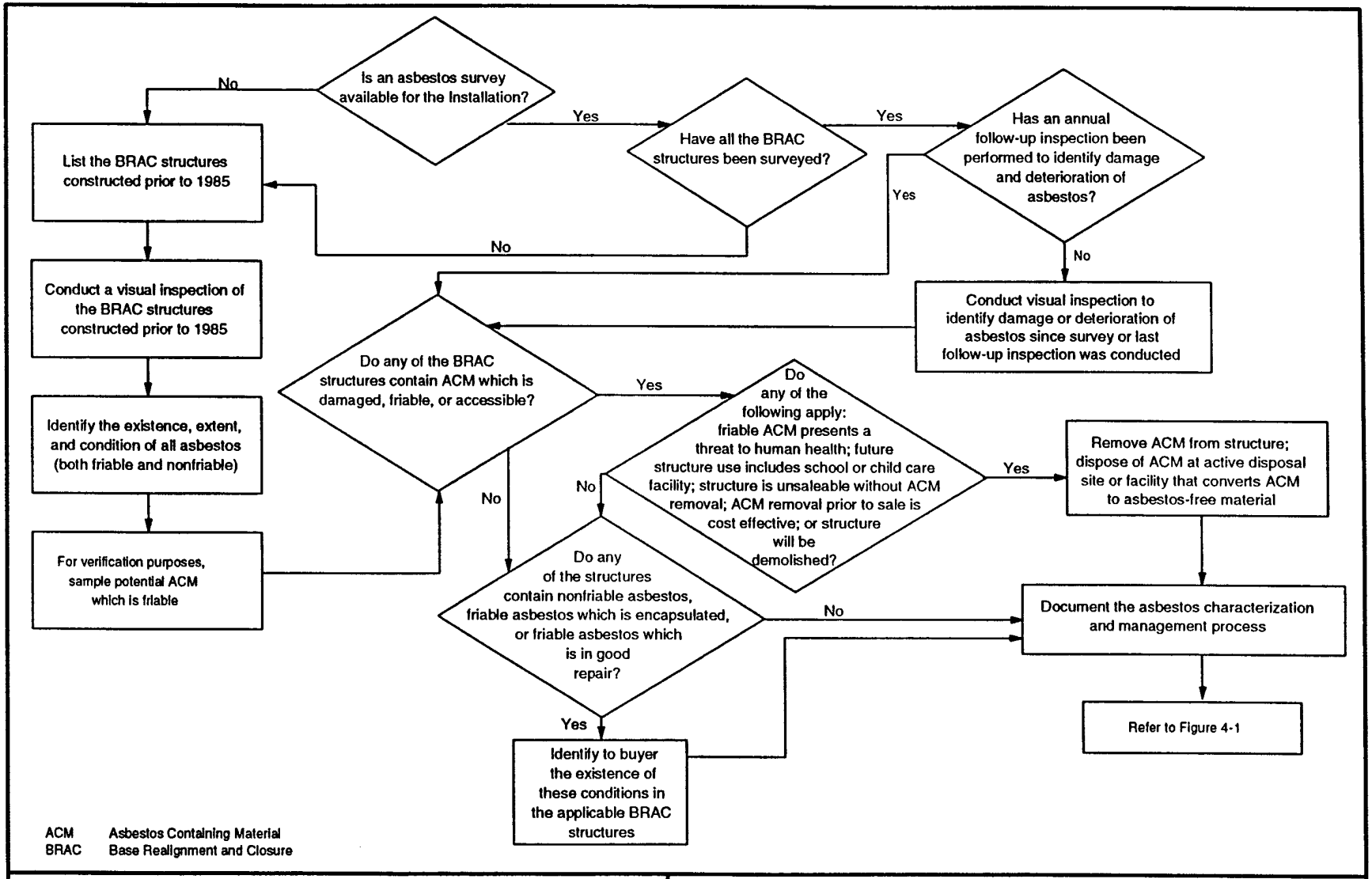
Buildings most likely to contain friable asbestos are those built or remodeled between 1945 and 1978 (Pringle, 1991). During the conduct of CERFA evaluations, the Army uses a construction cut-off date of 1985 to identify those structures which may potentially contain ACM (USAEC, 1993b). Likewise, the SPMP utilizes this cut-off date to aid in preliminary identification of structures which may require inspection and possible sampling.

Figure 4-2 identifies the steps required to characterize and manage ACM in BRAC structures. This process is based largely on Army policy guidance for BRAC properties (ACSIM, 1993).

An inventory of the BRAC structures should be prepared as discussed in Section 4.3.1, followed by a compilation of the historical/operational data for each structure as detailed in Section 4.3.2. If available, the installation-wide asbestos survey should be obtained and reviewed to determine whether the BRAC structures have been inspected and sampled for ACM. If an asbestos survey has not been conducted for all of the BRAC structures or if annual follow-up inspections have not been conducted, then those structures constructed prior to 1985 must be visually inspected.

A visual inspection of all of the structures should be conducted and documented in accordance with Army protocol designated for asbestos surveys (AR 200-1 and Technical Manual 5-612, both in the process of being revised), EPA's Guidance for Controlling Asbestos-Containing Materials in Buildings, and 40 CFR 61, Subpart M, Asbestos Survey Guidance, such that friable and nonfriable asbestos are identified with regard to existence, extent, and condition. AR 200-1 also indicates that the existence, extent, and condition of the ACM should be validated prior to renovation, demolition, or excessing. AR 200-1 indicates that asbestos survey work must be conducted by accredited personnel meeting the inspector training requirements of the Asbestos Hazard Emergency Response Act or other applicable Federal, State, and local requirements. Additionally, supervision must be conducted by a qualified person as specified in 29 CFR 1926.58.

ACM will not be removed for the sole purpose of eliminating asbestos. However, ACM will be removed from BRAC structures if one of the following applies (ACSIM, 1993):



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Rev: 09/20/94
AEC_TEP\DO2\INTRMFL\FIG42IF.DRW

Figure 4-2
Asbestos Characterization and Management Flow Chart

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- Protection of human health requires removal
- Future structure use includes school or child care facility
- Property is unsalable without removal or removal prior to sale is cost-effective
- Structure will be demolished

Only friable asbestos which presents a threat to health and safety must be removed. Nonfriable asbestos or friable asbestos which is encapsulated or in good repair should be left in place and identified to the buyer. It is important to note that ACM incorporated into a building structure has not been stored, disposed of, or released in the meaning of the NCP. Thus, Federal property transfer requirements of 40 CFR 373 are not applicable to this material.

To meet the validation requirements specified in AR 200-1 and the stipulations with regard to the removal of only friable asbestos in BRAC structures, sampling of potential ACM which is friable is recommended. Samples should be collected from representative areas of homogeneous friable material which is considered to be potential ACM. If a number of structures can be grouped based on similarities in year constructed, historical use, and maintenance history, then sampling may be minimized. Using the statistical approach outlined in Section 4.4.4.2 for lead-based paint investigations, only a select number of the total structures must be sampled. The results from the investigation are then applied to the remaining structures based on a 95 percent confidence level. Sampling should be conducted in accordance with Army and EPA protocol.

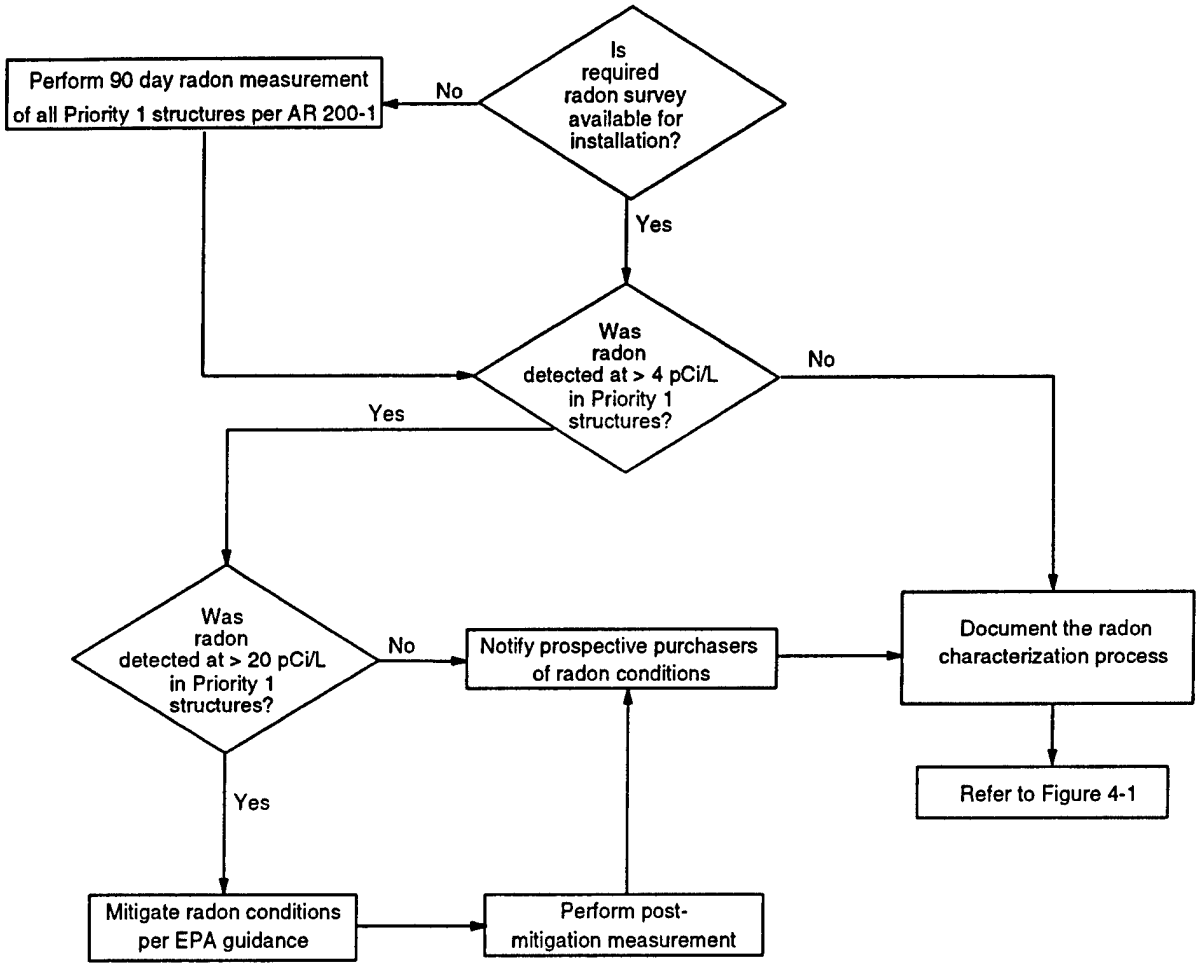
If the buyer intends to demolish a structure and control asbestos emissions in accordance with National Emissions Standards for Hazardous Air Pollutants (NESHAP) or if the buyer intends to remove the hazardous asbestos before re-occupancy, abatement of friable asbestos that presents a health threat based on future occupancy may not be required. Negotiations with the buyer will be necessary to ensure that the Army's liability is minimized (ACSIM, 1993).

ACM abatement and disposal should be conducted in accordance with all Federal, State, and local laws and regulations. Results of sampling, assessment, or mitigation activities conducted with regard to BRAC structures should be documented as appropriate in any on-going or future EBSs.

4.4.2 Radon

Radon is a colorless, odorless, and tasteless radioactive gas (at normal temperatures and pressures), released by the natural radioactive decay of uranium. Radon gas may enter a structure (e.g., through dirt floors and foundation cracks), become attached to dust particles, and be inhaled. The dust particles can become trapped in the lungs where they irradiate tissues increasing the risks of lung cancer. There are no Federal rules regulating radon gas in the home or workplace.

The structures of concern to the characterization and management of radon contamination in BRAC structures are Priority 1 structures (day care centers, hospitals, schools, and residences), because these are most likely to continue to have sustained human presence with the highest potential for increased cancer risks. Figure 4-3 identifies the steps necessary to characterize and manage radon contamination in BRAC structures. This process is based



>	Greater than
AR	Army Regulation
EPA	U.S. Environmental Protection Agency
pCi/L	picocurie per liter

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U.S. Army Environmental Center

Figure 4-3

Radon Characterization and Management Flow Chart

Rev: 09/20/94
AEC_TEP\DO2\INTRMFL\FIG43IF.DRW

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partly on the requirements of AR 200-1 (Chapter 11) and the USAEC Policy and Guidance Fact Sheet (USAEC, 1993c), and is modified for base closure situations.

An inventory of the BRAC structures should be prepared as discussed in Section 4.3.1, followed by a compilation of historical/operator data for each structure as detailed in Section 4.3.2. If available, the installation-wide radon survey (required by AR 200-1 for completion by the end of fiscal year (FY) 1991) should be obtained and reviewed to determine whether all Priority 1 structures have been measured for radon. If the radon survey has not been completed for all Priority 1 structures, a 90-day radon measurement should be performed for all such structures not previously measured. The 90-day measurement typically uses charcoal canisters placed in the lowest area of the structure that has a finished hard surface floor, at the time of the year that the structure is most closed to outside elements (winter in cool climates; summer in hot climates).

For structures that have been mitigated by a prior effort, prospective purchasers will be notified of the radon mitigation actions. If radon was measured at greater than 4 pCi/L but less than 20 pCi/L and no mitigation has occurred to date, prospective purchasers will be notified of the radon conditions. Notification will include a statement that 90-day radon measurements generally overstate average annual radon conditions by a factor of two to four. Mitigation or establishment of long-term (180 or 365 day) measurement within structures where initial measurements are between 4 and 20 pCi/L may not be required for BRAC structures. Consistent with DOD guidance for mitigation of lead-based paint hazards in BRAC structures, the determination of whether to perform long-term measurement and mitigate the radon conditions between 4 and 20 pCi/L will be made on a case-by-case basis at the installation and will consider timing of the base closure and the cost effectiveness of such mitigation relative to sales terms.

If radon was measured at greater than 20 pCi/L in Priority 1 structures and no mitigation has occurred to date, mitigation of the radon conditions will be conducted per EPA guidance (EPA, 1986a; EPA, 1988). Mitigation techniques include sealing foundation cracks and increasing indoor air flow. Post-mitigation measurement using charcoal canisters should be performed to verify that radon levels are reduced to below 20 pCi/L. Additional mitigation actions should be taken if post-mitigation radon levels are higher than 20 pCi/L. Prospective purchasers should be notified of the radon conditions.

The radon characterization and management process should be documented in the EBS documents, as appropriate.

4.4.3 Polychlorinated Biphenyls

PCBs are relatively inert, halogenated organic compounds that are prone to adsorption by soils and sediments and are resistant to photolysis, oxidation, and attack by both acids and bases. Consequently, PCBs are quite persistent in the environment and tend to bioaccumulate significantly. PCBs are a probable human carcinogen.

PCBs are commonly used in dielectric fluids in electric transformers and capacitors. Though TSCA banned most new production and use of PCBs beginning in 1979, use of PCBs in older systems is still prevalent. PCB-containing electrical equipment exists at many Army installations both in service and in storage. The areas of concern for BRAC structures relative to PCBs are spills and PCB-containing equipment in storage.

Figure 4-4 identifies the overall steps necessary to characterize and manage PCBs and associated equipment in BRAC structures. An inventory of the BRAC structures should be prepared as discussed in Section 4.3.1, followed by a compilation of historical/operator data for each structure as detailed in Section 4.3.2. If available, the installation's PCB inventory (required by AR 200-1) should be obtained and reviewed to determine whether PCBs and/or PCB-containing equipment exist on base. Other than documentation, there are no further requirements for characterization and management of PCBs at BRAC structures if the following are true: 1) PCBs or PCB-containing equipment do not exist at the installation; 2) all PCBs and associated equipment are still in service; or 3) any spills have been remediated in compliance with TSCA. However, remedial and disposal efforts are indicated if PCBs are being stored or if unremediated spills are known to exist.

4.4.3.1 Polychlorinated Biphenyl Disposal

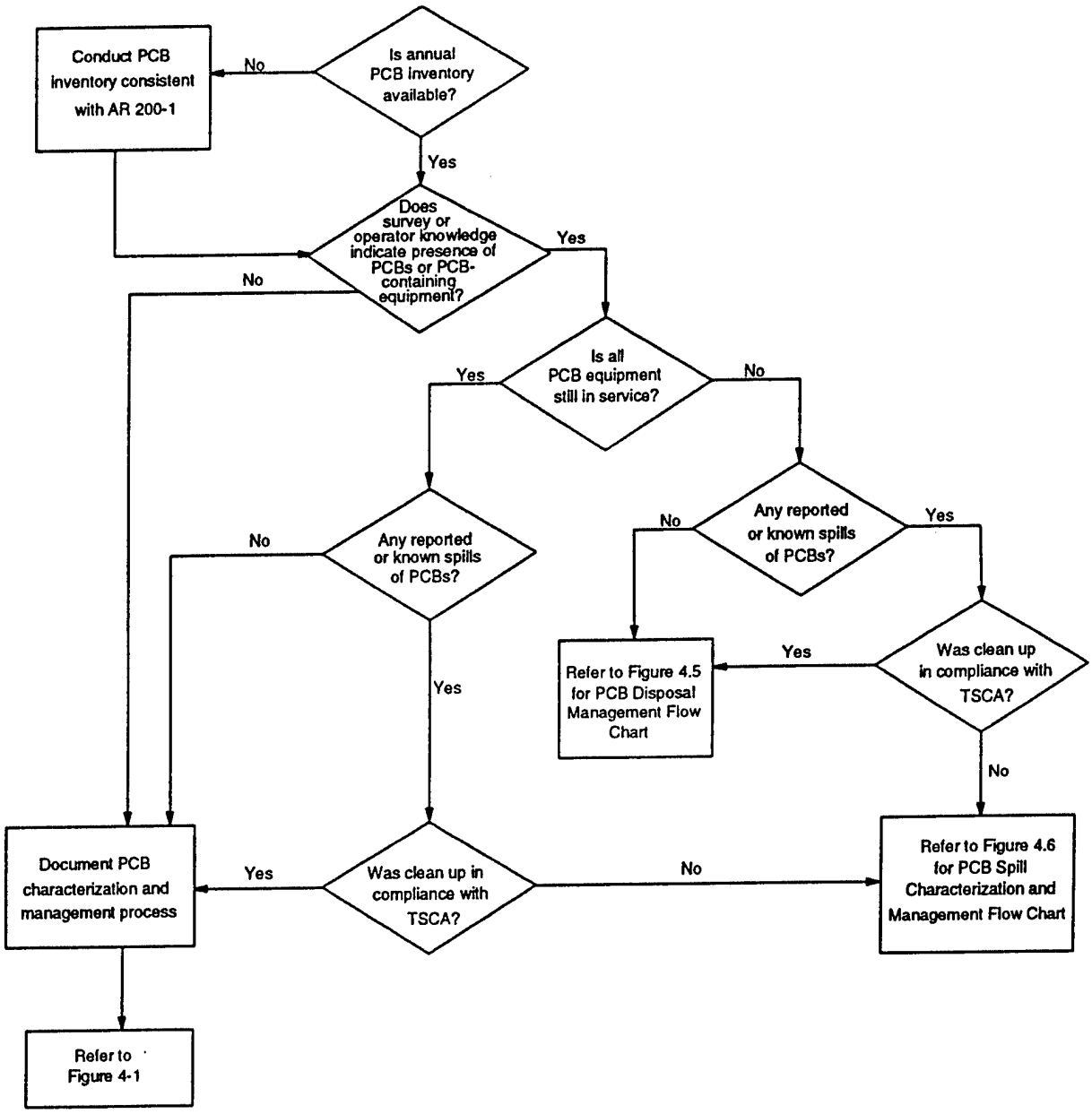
Figure 4-5 identifies remedial and disposal options to be followed for PCB liquids, equipment, and rags/debris. Specific options are based on the requirements of TSCA, and are determined by whether PCBs in liquids, equipment, or debris are at levels greater than 500 parts per million (ppm) or between 50 and 500 ppm. For PCBs in stored liquids, equipment, or debris at levels below 50 ppm, no requirements apply; however, dilution to levels below 50 ppm to avoid disposal and remediation requirements is not allowed.

AR 200-1 requires that the installation's annual PCB document form the basis for compliance with TSCA's requirements. Accordingly, the PCB document should be sufficiently detailed to determine PCB levels and resultant remedial and disposal options.

4.4.3.2 Polychlorinated Biphenyl Spills

Figure 4-6 identifies the procedures to be considered if unremediated spills exist within BRAC structures. These procedures are based on TSCA regulations (40 CFR 761), and are supplemented by EPA guidance documents (EPA, 1985b; EPA, 1990a). TSCA's Spill Cleanup Policy formally applies only to recent spills; however, the policy's protocols and clean-up levels are the only guidance for PCB cleanup in structures. Further, as codified policy representing substantial scientific and technical research, TSCA's Spill Cleanup Policy should be a prime consideration in cleanup of unremediated spills within BRAC structures. The recommended cleanup levels should be considered "points of departure" or overall cleanup goals rather than absolute requirements.

Recommended procedures and cleanup options for structures depend on concentration and amount of PCBs spilled with actions for spills of less than 500 ppm or 1 pound of PCBs limited to indoor residential surfaces. Further options depend on whether PCBs were spilled onto porous or nonporous surfaces. Wash/rinsing or other in-situ techniques are recommended to clean nonporous surfaces to 10 micrograms (µg)/100 square centimeters (cm^2) for most indoor surfaces or to 100 µg/100 cm^2 with encapsulation for indoor, low contact nonporous surfaces when the spill area does not have an unrestricted access. Cleaning is to be verified by wipe sampling using a 100 cm^2 template. The top 1 centimeter (cm) of porous surfaces are of primary concern, and may be encapsulated, removed, or otherwise cleaned to less than 1 ppm PCBs (for unrestricted areas) or less than 25 ppm (for restricted areas). Wipe sampling is inappropriate for porous surfaces. Recommended sampling techniques are removal of a discrete object (e.g., masonry bricks) or use of chisels, drills, or saws to gather a sufficient sample within the uppermost 1 cm.



AR Army Regulation
PCB Polychlorinated biphenyl
TSCA Toxic Substances Control Act

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AEC_TEP\DO2\INTRMFL\FIG44IF.DRW

Figure 4-4

Polychlorinated Biphenyl Characterization and Management Flow Chart

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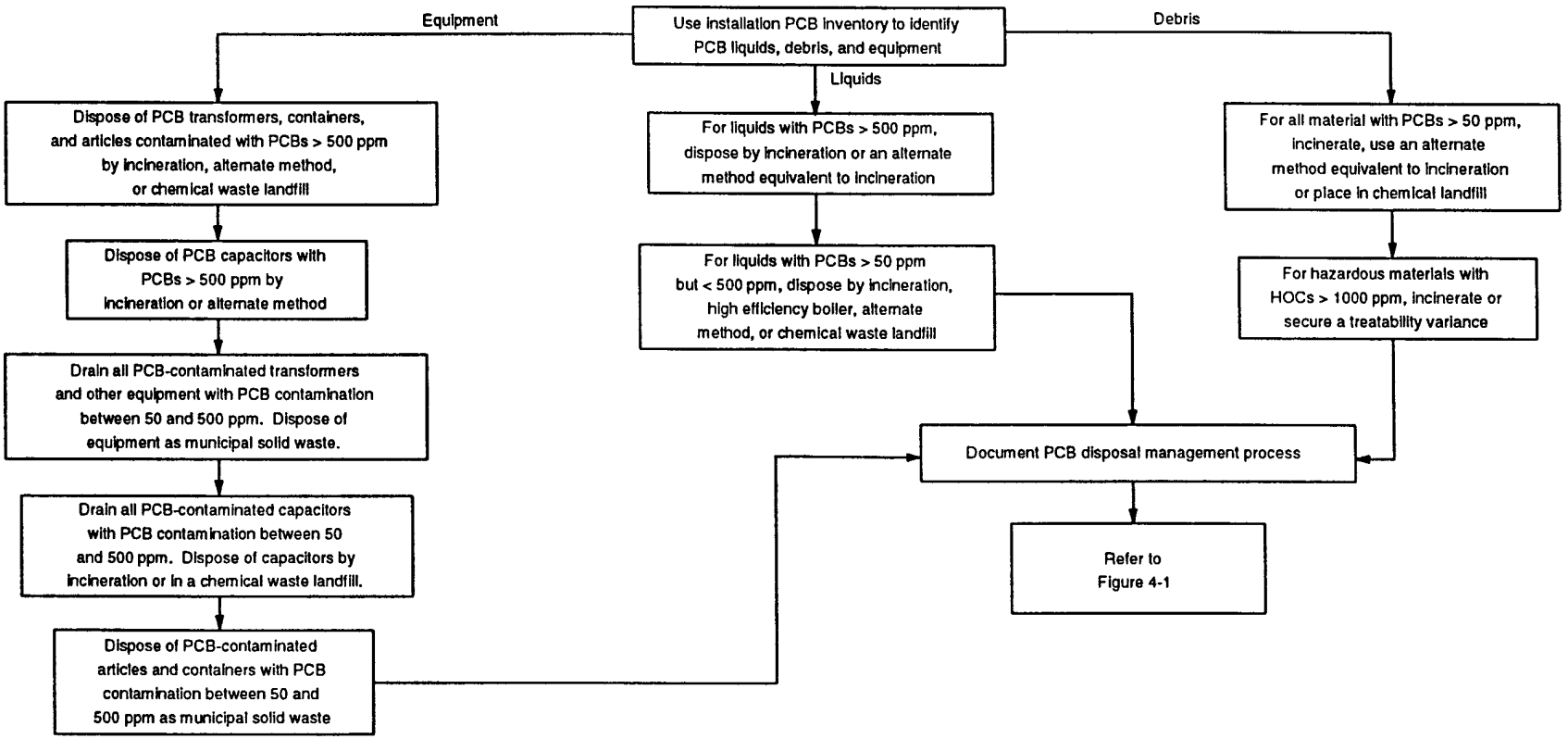

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Figure 4-5
Polychlorinated Biphenyl Disposal Management Flow Chart

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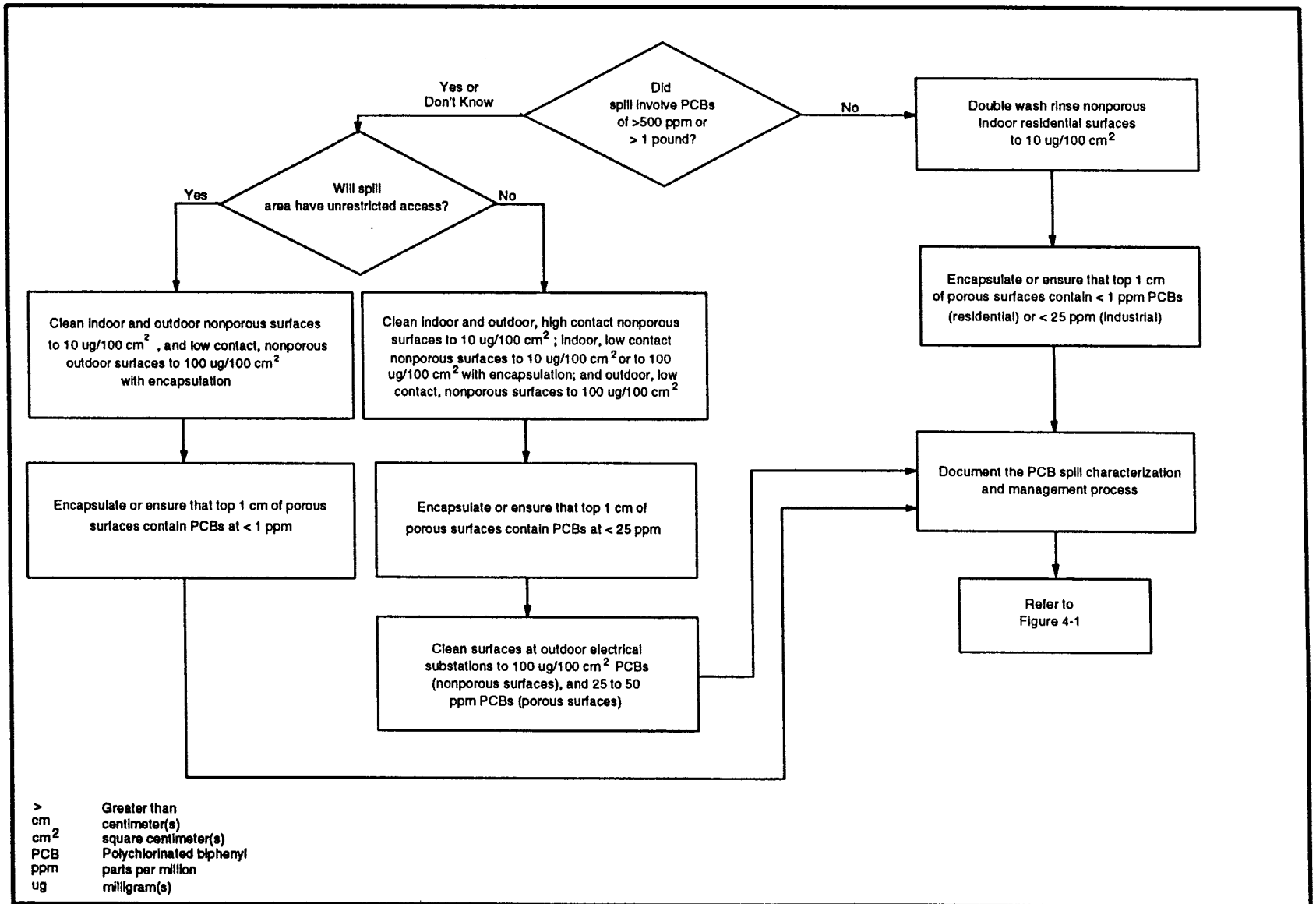

>	Greater than
cm	centimeter(s)
cm^2	square centimeter(s)
PCB	Polychlorinated biphenyl
ppm	parts per million
ug	milligram(s)

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AEC_TEP\DO2\INTRMFL\FIG46IF.DRW

Figure 4-6
Polychlorinated Biphenyl Spill Characterization and Management Flow Chart

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EPA guidance (1985b) should be consulted to determine the sample size and design layout in the field. Typical spills require 19 samples. Small spills with a radius of 4 feet (ft) or less require seven samples, while larger spills with a radius of more than 11 ft require 37 samples. Samples should be taken on a hexagonal grid as explained in the EPA guidance document.

4.4.4 Lead-Based Paint

It is Army policy to transfer BRAC properties in a cost effective manner which facilitates disposal of properties while protecting human health from lead-based paint hazards. Buildings most likely to contain lead-based paint are those constructed prior to 1978. The Army uses this construction cut-off date to identify structures which may potentially contain lead-based paint (ACSIM, 1993). Likewise, the SPMP utilizes this cut-off date to aid in identification of structures which may require inspection and possible sampling.

Figure 4-7 identifies the steps required to characterize and manage lead-based paint in residential BRAC structures. This process is based largely on Army protocol and dependent on the date that the BRAC properties are planned for disposal (i.e., prior to or after January 1, 1995). For demolition purposes any structure constructed prior to 1978 is of concern with regard to the potential that debris may contain lead-based paint. However, for structures with a future use, only those constructed prior to 1978 which are intended for use as residential habitation are of concern.

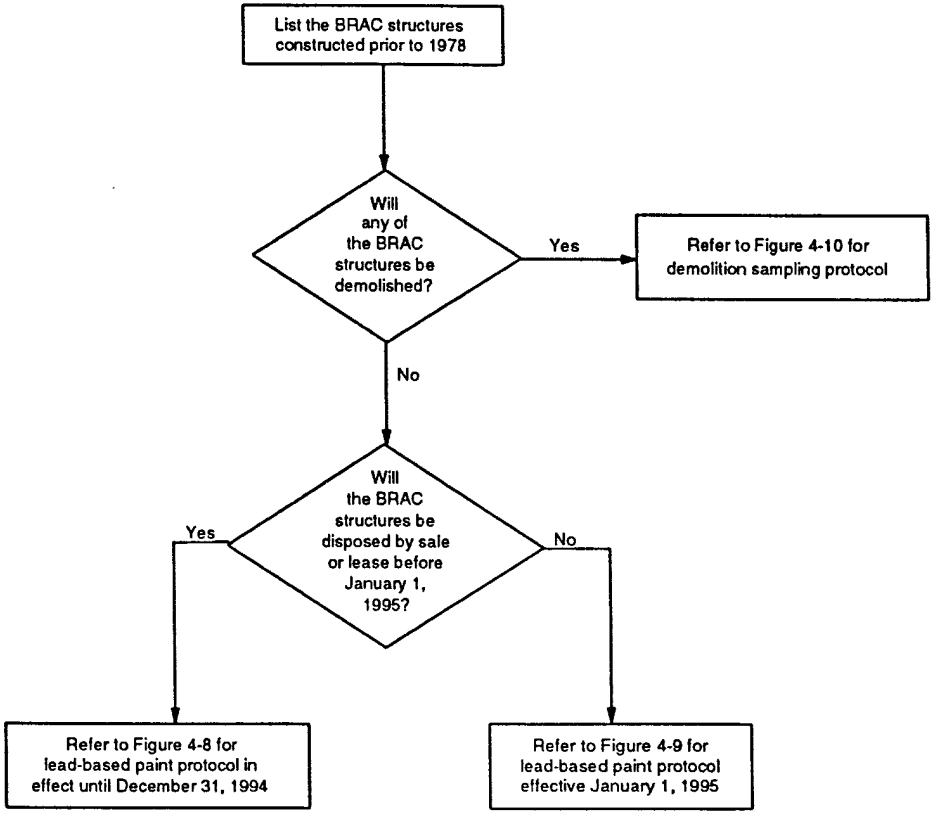
An inventory of the BRAC structures should be prepared as discussed in Section 4.3.1, followed by a compilation of the historical/operational data for each structure as detailed in Section 4.3.2. The protocol to follow next is outlined in following subsections and depends on whether the BRAC structures will be used for residential habitation and the date of disposal or whether the BRAC structures will be demolished.

4.4.4.1 Residential Structures to be Disposed prior to January 1, 1995

Figure 4-8 identifies the process to be followed for those BRAC structures which will be disposed before January 1, 1995, and is primarily based on Army policy guidance (ACSIM, 1993; ASA (IL&E), 1993). Under this guidance, residential structures also include properties constructed after 1977 in which lead-based paint was applied and nondwelling properties commonly used by children under 7 years of age (e.g., playgrounds, schools, and child care centers). The guidance stipulates that the Army must ensure that properties sold or leased for residential habitation are free of immediate lead-based paint hazards (defined below) prior to residential habitation. If sale or lease of the property occurs before the Army can properly identify and/or treat the immediate lead-based paint hazards, conditions of sale or lease will prevent the use of the properties for residential habitation until hazards existing at the time of sale or lease have been eliminated by either the Army or the buyer/lessee.

Immediate lead-based paint hazards are identified as interior or exterior painted surfaces of residential structures on which the paint is cracking, scaling, chipping, peeling, or loose. All such defective paint surfaces are assumed to be immediate lead-based paint hazards, unless testing confirms that the defective surface does not contain lead-based paint.

A surface-by-surface visual inspection of painted surfaces must be conducted in the residential structures to identify defective paint. Guidance for conducting visual inspections is



BRAC Base Realignment and Closure

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U.S. Army Environmental Center

Rev: 09/20/94
AEC_TEP\DO2\INTRMFL\FIG47IF.DRW

Figure 4-7

Lead-Based Paint Characterization and Management Flow Chart

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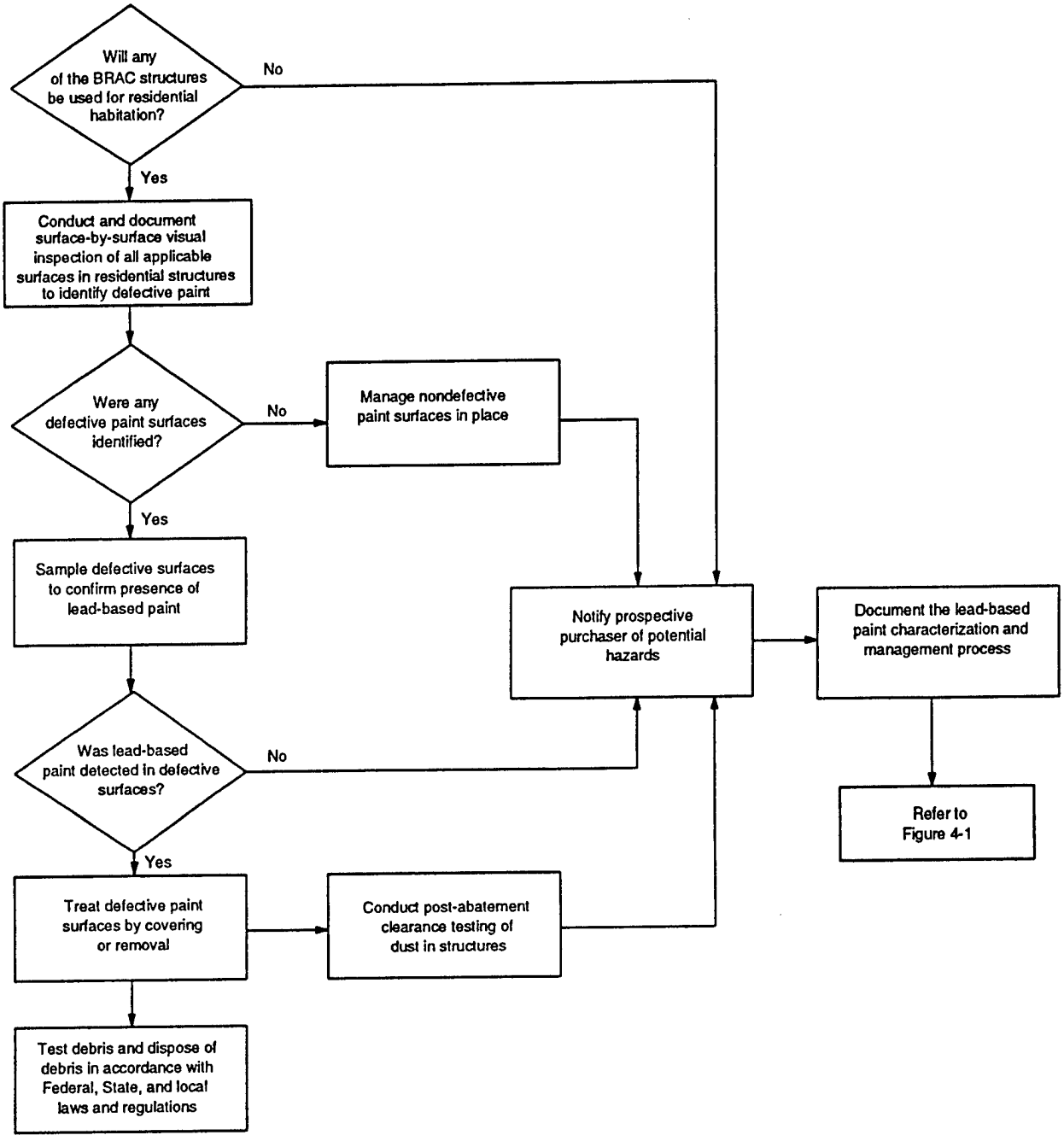

BRAC Base Realignment and Closure

Prepared for:

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Rev: 09/20/94
AEC_TEP\DO2\INTRMFL\FIG48IF.DRW

Figure 4-8

Lead-Based Paint Protocol in Effect until December 31, 1994

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provided in U.S. Army Engineering and Housing Support Center (AEHSC) Technical Note 420-70-2 (1991). Personnel managing or performing inspections or surface treatment must be trained according to applicable Federal, State, and local requirements. Sampling for lead in paint, dust, and soil is not currently required under Federal regulations. However, confirmation testing of the defective surfaces is highly recommended to avoid costly treatment of defective paint which is not lead-based. Applicable surface sampling sites are discussed in Section 4.4.4.2.

If a number of the BRAC structures can be grouped based on similarities in year constructed, historical use, and maintenance history, then inspection and sampling may be minimized. Using the statistical approach outlined in Section 4.4.4.2, only a representative number of the total structures are inspected and sampled. The results from the investigation are then applied to the remaining structures based on a 95 percent confidence level.

Treatment includes covering or removal of the defective paint surfaces such that the immediate lead-based paint hazard is permanently eliminated. Covering can be accomplished by adding a layer of wallboard to the wall surface. Covering or replacing trim surfaces is also permitted. Paint removal can be accomplished by scraping, heat treatment (infra-red or coil type heat guns), chemicals, or replacement of the painted structure component. Machine sanding, dry hand sanding, and use of propane or gasoline torches (open-flame methods) are not permitted. Washing and repainting without thorough removal or covering does not constitute adequate treatment. In the case of defective paint spots, scraping and repainting the defective area is considered adequate treatment. Abrasive removal of paint by either wet hand sanding or scraping of lead-based paint must be accompanied by the use of a high efficiency particle air filtered vacuum.

Clearance testing of dust should also be conducted after abatement measures are completed and the area has been cleaned up properly. The maximum levels of lead allowable in dust include (ASA (IL&E), 1993):

- 200 µg/square feet (ft^2) on floors
- 500 $\mu g/ft^2$ in window sills (stools)
- 800 $\mu g/ft^2$ in window wells

In-place management of nondefective paint surfaces should be conducted between the time that residential structures are inspected and the time that the properties are sold or leased. In-place management includes preventative maintenance and periodic cleaning. Surfaces known or suspected to be painted with lead-based paint should be monitored. Chipping and peeling paint and dust suspected to contain lead should periodically be cleaned up.

The waste from each lead-based paint project should be tested unless the quantity is so small that testing is more costly than disposing of the material as hazardous waste or previous tests have determined what the results will be. Nonhazardous and hazardous debris should be disposed in accordance with Federal, State, and local laws and regulations.

If evidence suggests that lead-based paint is present in the residential BRAC structures, even if no hazards are identified, prospective purchasers must be notified prior to purchase. Notification should include the following information:

- Structure was constructed before 1978 or was constructed after 1977 if lead-based paint was applied to applicable surfaces
- Structure may contain lead-based paint
- Hazards of lead-based paint
- Symptoms and treatment of lead-based paint poisoning
- Precautions to be taken to avoid lead-based paint poisoning (including maintenance and removal techniques for eliminating hazards)
- Results of inspection, assessment, or testing for lead-based paint and lead-based paint hazards

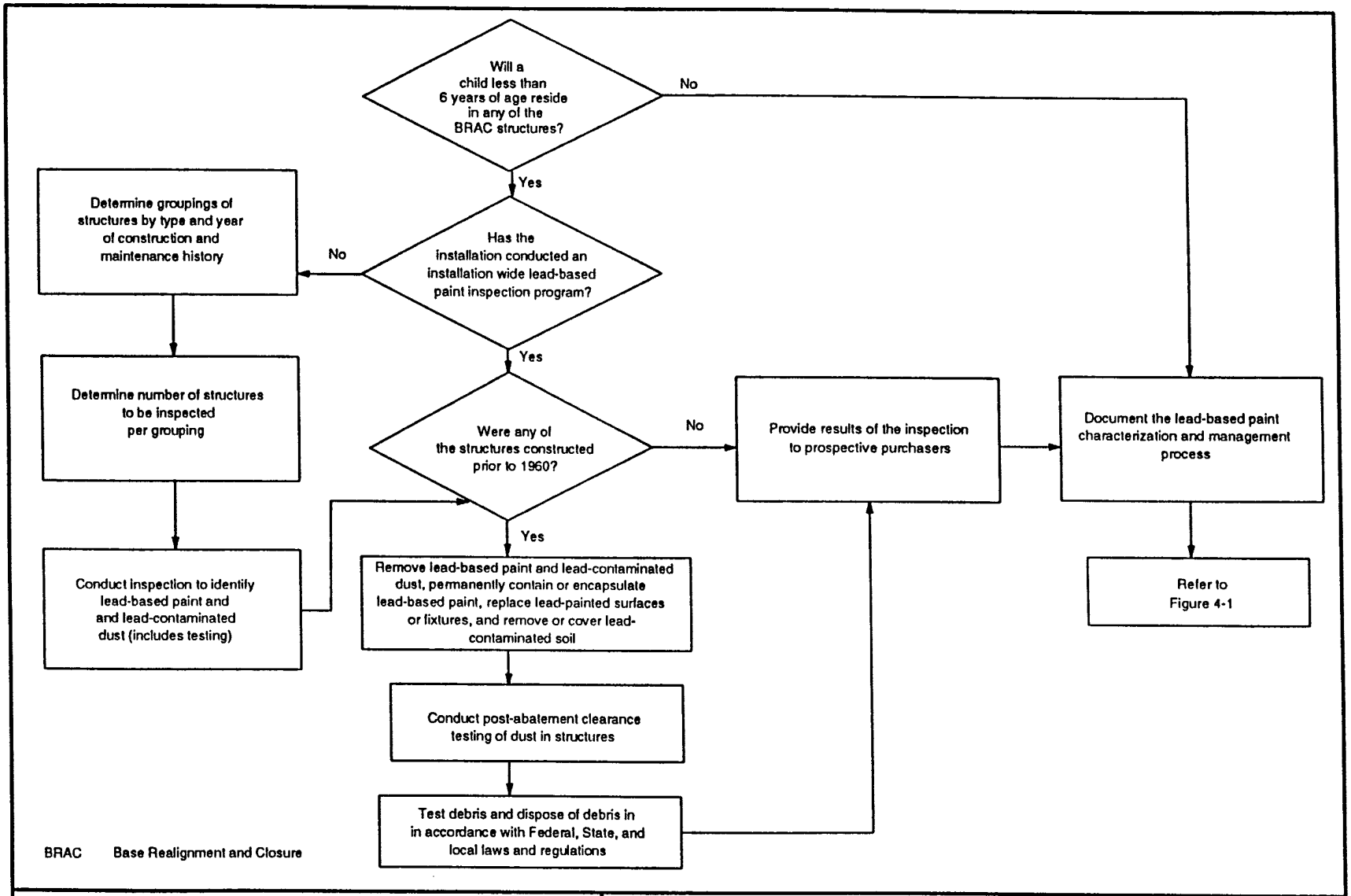
4.4.4.2 Residential Structures to be Disposed after January 1, 1995

Figure 4-9 contains the process for those BRAC structures which will be disposed after January 1, 1995, and is based primarily on Public Law 102-550 and Army policy guidance (ACSIM, 1993; ASA (IL&E), 1993). Under Public Law 102-550, structures of concern are referred to as target housing and include any Army housing constructed before 1978 in which any child less than 6 years of age resides or is expected to reside. Inspection and abatement of lead-based paint hazards in Army owned target housing is required for those structures constructed prior to 1960. Under this guidance, lead-based paint hazards include any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, and lead-contaminated paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects. For those structures constructed prior to 1978 and after 1960, inspection is required with results made available to prospective purchasers. In this case, abatement of lead-based paint hazards is not required.

If a BRAC structure has not been inspected for lead-based paint hazards, then the structure must be inspected. Structures can be combined into groups based on similarities such as type and year constructed and maintenance history. The number of structures which require inspection can then be determined statistically using Table 4-1. The number of facilities inspected will provide 95 percent confidence that testing results can be applied to all units or buildings in a particular grouping. Testing for lead-based paint and lead-contaminated dust is also conducted during the inspection. Table 4-2 contains a list of surface testing sites that should be sampled during the surface-by-surface investigation. Public Law 102-550 indicates that contractors, inspectors, and supervisors must complete a training program certified by the appropriate Federal agency.

For those structures constructed prior to 1960, Public Law 102-550 indicates that lead-based paint hazards should be permanently eliminated. This includes removal of lead-based paint and lead-contaminated dust, permanent containment or encapsulation of lead-based paint, replacement of lead-painted surfaces or fixtures, and removal or covering of lead-contaminated soil. Clearance testing of dust should also be conducted after abatement measures are completed and the area has been cleaned up properly. The maximum levels of lead allowable in dust are stated in Section 4.4.4.1.

In-place management practices should be used pending treatment in BRAC structures constructed prior to 1960 or to monitor conditions in BRAC structure constructed between 1960 and 1978 prior to sale or lease.



Prepared for:

U.S. Army Environmental Center

Rev: 09/20/94
I:\AEC_TEP\DO2\INTRMFL\FIG49IF.DRW

Figure 4-9

Lead-Based Paint Protocol Effective January 1, 1995

Prepared by: AGEISS Environmental, Inc.

INTERIM FINAL

Table 4-1. Determination of the Number of Structures to be Inspected for Lead-Based Paint.

Number of Units or Buildings in Grouping	Number of Units or Buildings to be Inspected[1]
20	All
40	31
60	38
80	42
100	45
200	51
300	54
400	55
600	56
1000	57
> 1000	58

> Greater than

1 This sample size will provide 95 percent confidence that testing results can be applied to all units or buildings in the grouping.

SOURCE: ASA (IL&E), 1993

Table 4-2. Lead-Based Paint Surface Testing Sites.

INTERIOR[1]	
Baseboard	1 in each area
Ceiling	In each area
Crown molding	1 in each area
Door	Surface of door and one side of the frame on a representative interior door in each area
Fireplace	1 if present
Floor	1 in each area
Radiator	1 in each area
Shelf	1 in each area
Shelf support	In each area
Stairs	1 each of riser, tread, stringer, newel post, railing cap, balustrade
Wall	1 each of upper wall, lower wall, and chair rail (if applicable) in each area
Window	1 each of sash, casing, and sill on a representative window
EXTERIOR[1]	
Ceiling	1 in each area
Door	1 of each surface of door and door casting
Fence	1 each
Floor	1 each
Joist	1 each
Lattice	1 each
Railing	1 each
Painted roofs	1 each
Porch	1 each
Railing cap	1 each
Siding	1 each
Stairs	1 each of tread, riser, and handrail
Support column	1 each
Trim	1 each of upper and lower
Window	1 each of sill, casing, sash, and well on a representative window (also cellar window unit)

1 In each area (each room, closet, pantry, hall, part of a divided room, such as the dining area of a kitchen/dining room, etc.), the listed painted surfaces or horizontal surfaces below painted surfaces will be tested.

SOURCE: ASA (IL&E), 1993

The waste from each lead-based paint project should be tested unless the quantity is so small that testing is more costly than disposing of the material as hazardous waste or previous tests have determined what the results will be. Nonhazardous and hazardous debris should be disposed in accordance with Federal, State, and local laws and regulations.

4.4.4.3 Structures to be Demolished

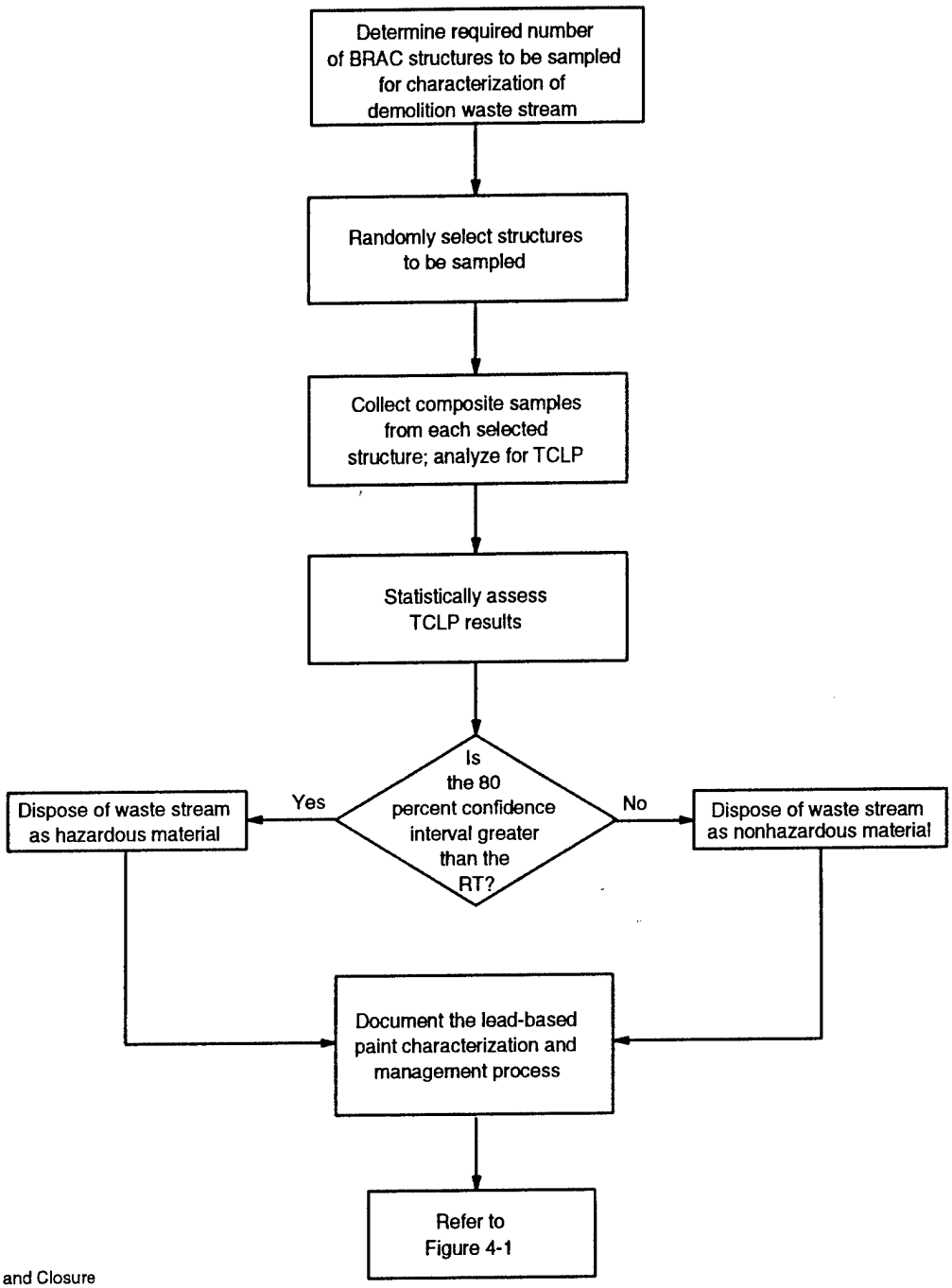
Figure 4-10 contains the process for those BRAC structures (with lead-based paint) which will be demolished. This process is based on the Army policy guidance detailed in the U.S. Army Environmental Hygiene Agency (AEHA) (Undated) document entitled Sampling Protocol Building Demolition Debris and Buildings Painted with Lead-Based Paint. This protocol applies to those BRAC structures which may potentially contain lead-based paint as preliminarily identified by their year of construction (prior to 1978). It should be noted, that BRAC structures should not be demolished until all other potential hazards have been identified and mitigated as required. Such hazards could include the presence of ACM or potential contamination of structural material with PCBs or process contaminants.

The debris which will be generated during a given demolition project at a given site/installation is considered the waste stream for characterization purposes. Using EPA guidance (EPA, 1986b; EPA, 1989) a statistical approach is taken to estimate the number of structures which require sampling such that an 80 percent confidence level in the resulting determination (hazardous versus nonhazardous) will be ensured. Table 4-3 lists the number of structures to be sampled based on the total number of structures which will be demolished. Structures to be sampled should be selected randomly. However, when one or more groups of identical structures will constitute a portion of the waste stream, an appropriate percentage of these structures should be selected from the individual groups.

One composite sample should be obtained from each selected structure. The composite should include appropriate proportions (subsamples) of all materials which comprise the structure. Structure components, such as ACM, scrap metal, glass, screen, or wiring should not be sampled. Generally, 20 to 30 subsamples are necessary to makeup one 110 gram composite sample. The samples should be extracted using EPA Method 1311, the Toxicity Characteristic Leaching Procedure (TCLP). The TCLP results for lead should be statistically analyzed to access the variability among the structures and overall normality of the lead distribution. The 80 percent confidence interval (CI) should then be calculated and compared with the regulatory threshold (RT) for lead, which is 5.0 milligrams per liter. If the CI is greater than the RT, then the waste stream is characterized as hazardous material. If the CI is less than the RT, the waste stream is considered nonhazardous.

The AEHA (Undated) is compiling analytical results obtained using this protocol for input into a database. Sampling may be minimized if adequate hazardous waste characterization baseline data is available for the types of structures that comprise the waste stream.

In each of the above cases for future or nonfuture use BRAC structures, results of any sampling, assessment, or mitigative activities should be documented as appropriate in on-going or future EBSs.



BRAC Base Realignment and Closure
RT Regulatory Threshold
TCLP Toxicity Characteristic Leaching Procedure

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Figure 4-10

Lead-Based Paint Sampling Protocol for Demolition Waste Streams

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Table 4-3. Statistical Determination of the Number of Structures to be Sampled prior to Demolition.

Number of Total Buildings	Number of Buildings to Sample[1]
1 - 9	All
11 - 15	10
16 - 20	13
21 - 30	16
31 - 40	21
41 - 100	26
> 100	32

> Greater than

1 These numbers are designed to meet or exceed the statistical requirements set by EPA. Both the power and the CIs were set at or above 90 percent and 80 percent, respectively, and the precision was established as 20 percent. The CV is assumed to be 35 percent. The actual CV will vary from case to case and should be determined when the analytical results are available. A complete statistical evaluation of the analytical data will involve a calculation of the actual CV and potentially include data transformations and/or adjustments to the other statistical parameters.

CI Confidence Interval
CV Coefficient of Variance
EPA U.S. Environmental Protection Agency

SOURCE: AEHA, Undated

4.4.5 Process Contaminants

Process contaminants include any organic or inorganic contaminant that may be present in a BRAC structure as a result of facility operation or windblown transport from contaminated areas external to the structure. Presently, there is no specific Army policy regarding the transfer of BRAC properties which may potentially contain process contaminants. However, it is Army policy to transfer BRAC properties in a cost-effective manner which facilitates disposal of the properties while protecting human health from hazards (e.g., Army policy with regard to asbestos or lead-based paint).

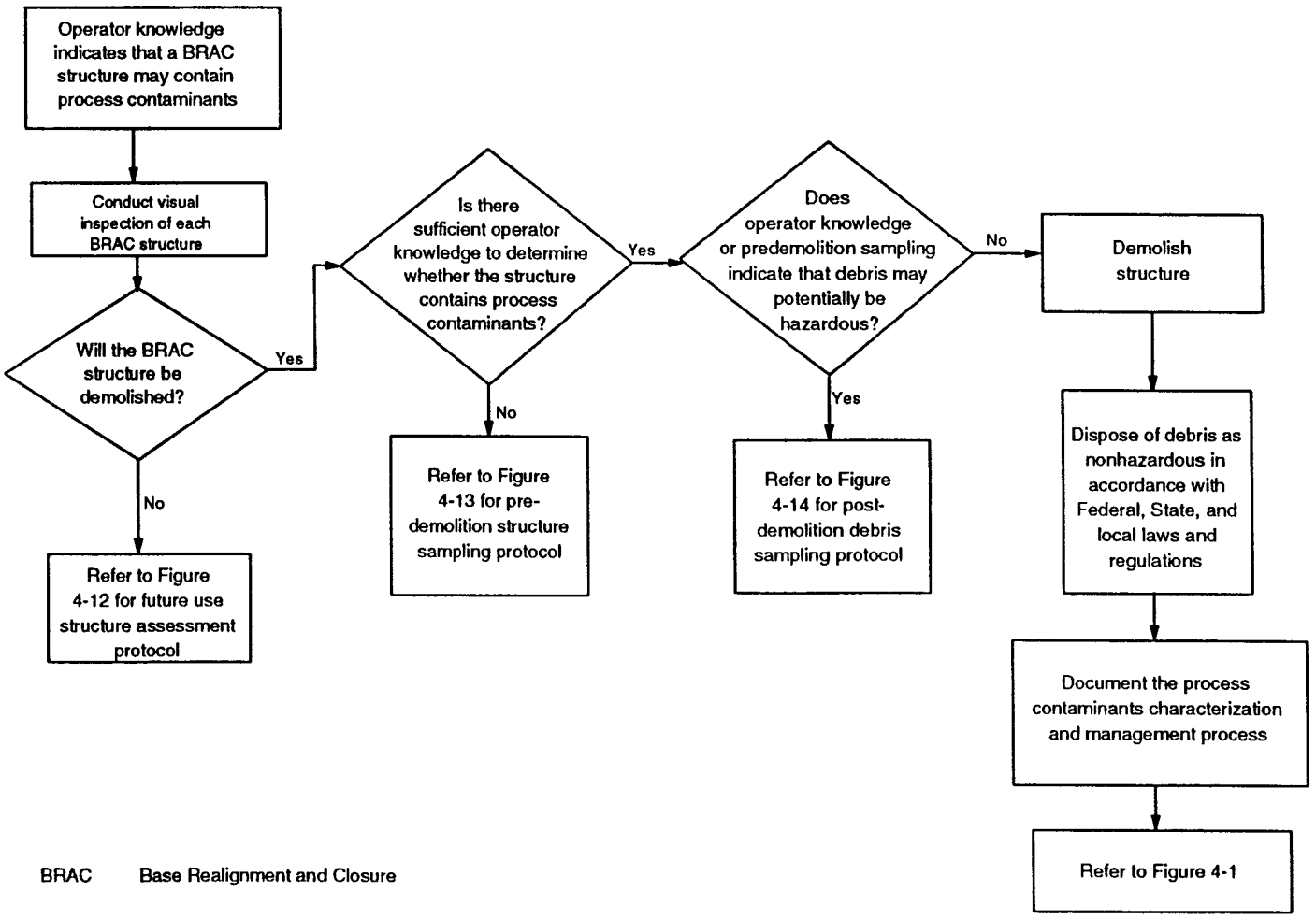
Structures most likely to contain process contaminants are those whose historic or current use can be classified in one of the following categories:

- Structure was or is being used in the manufacture, storage, transfer, or shipment of chemical products or raw materials
- A structure with no history of hazardous chemical use is located in close proximity to structures with chemical manufacturing history, and the potential exists for shared contamination effects (e.g., due to windblown contaminant transport)
- Documented spills have occurred within or immediately adjacent to a structure
- Listed waste(s) may have been or are being handled, stored, or used within a structure

The SPMP assumes that BRAC structures will not include any structures that could potentially be contaminated with chemical agent. Therefore, chemical agent monitoring, assessment criteria, and management procedures are not discussed in this plan.

Figure 4-11 identifies the steps required to characterize and manage process contaminants in BRAC structures. This process is based in part on protocol developed for the RMA (AGEISS, 1993a; AGEISS, 1993b).

An inventory of the BRAC structures should be prepared as discussed in Section 4.3.1, followed by a compilation of the historical/operational data for each structure as detailed in Section 4.3.2. Potential target process contaminants for the individual BRAC structures should be determined as part of the compilation of operator knowledge (i.e., historical/operational data). A visual inspection of each BRAC structure should be conducted to assess the structure's condition; identify areas which may require sampling; locate potential sampling points; and note the presence of process equipment, ACM, or other stored materials. Additionally, for BRAC structures which will be demolished pipelines and other utility equipment which will require removal prior to demolition should also be identified. Process equipment and stored materials should be removed prior to sampling. Any liquids or dust contained in the process equipment must be removed prior to equipment removal. The liquids, dust, and any unknown stored materials should be sampled and properly disposed depending on their hazardous nature. The equipment should be steam cleaned after removal from the structure and prior to release for reuse, scrapping, or disposal. PCB-containing equipment should be addressed consistent with the protocols of Section 4.4.3. ACM assessment and removal should follow protocol identified in Section 4.4.1.



BRAC Base Realignment and Closure

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Figure 4-11

Process Contaminants Characterization and Management Flow Chart

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The protocol to follow next is outlined in the following subsections and depends on whether the BRAC structures will likely be used in the future (i.e., future use structures) or whether the structures will be demolished (i.e., no future use).

4.4.5.1 Future Use Structures

All BRAC structures which may potentially contain process contaminants will be considered future use structures unless the Army plans to demolish the structures prior to disposal by lease or transfer. Figure 4-12 identifies the process to be followed for BRAC structures which will be used in the future, and includes sampling, assessment, and treatment phases for dust and air. Dust and air sampling should be conducted within each BRAC structure if operator knowledge is not sufficient to determine whether the structure contains process contaminants. However, if the inventory and historical use assessment indicates that dust or air contamination is likely, consideration may be given to treating (i.e., cleaning) the BRAC structures before conducting any initial air or dust sampling.

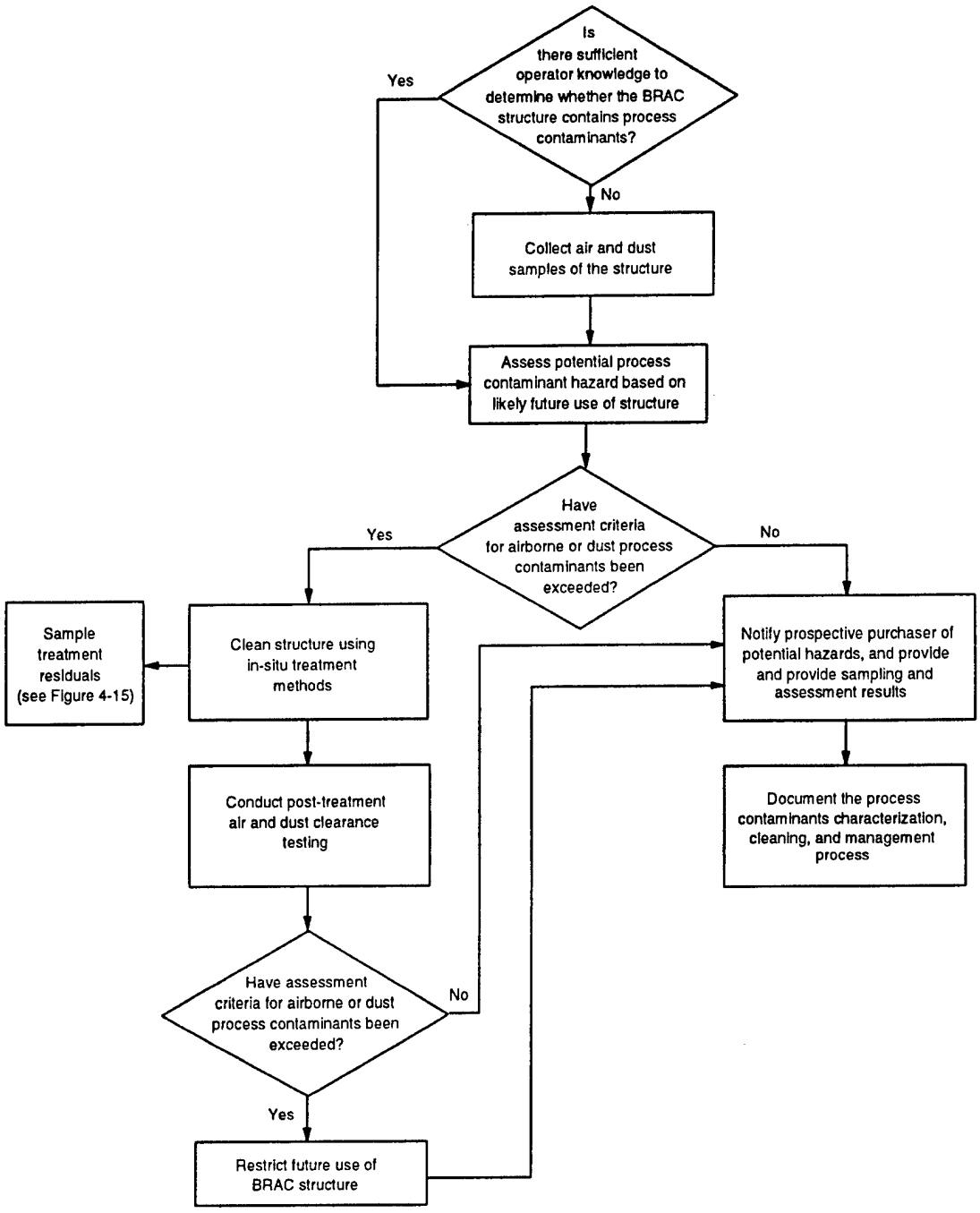
Dust and Air Sampling

Dust sampling can be conducted during the visual inspection of the structure. Both vacuum and wipe methods should be used to collect the dust samples, as pilot-scale studies indicate that each method provides useful information (AGEISS, 1993b). Wipe sampling provides data that are more representative of materials that workers may come in contact with, and provides better indication of dermal contact and exposure. However, vacuum sampling provides data which are representative of the level of contamination present in the entire building, are more reproducible than wipe samples, and are more directly comparable against concentration-based assessment criteria. For wipe samples, it is recommended that the most accessible surfaces (e.g., desks, window sills, and light fixtures) be sampled with a minimum of two samples per structural level. One composite vacuum sample per structural level is recommended and should be taken from the floor. Samples should be analyzed for those target process contaminants that are likely to be present based on operator knowledge.

Air sampling can be conducted as part of the visual inspection or at a later date. Sampling should be conducted for an 8-hour period using low-volume pumps which are placed on each floor of a structure, in an area that appears to have representative air flow. In general, one air sampler per analytical method should be used in each structure. However, in large structures or in structures where exposure could vary, two or more air samplers per method may be used. Samples to determine airborne contaminants and contaminants in air particulates should be collected. Samples should be analyzed for total suspended particulates and for those target process contaminants that are likely to be present in the structure based on operator knowledge.

Dust and Air Assessment

Criteria must be developed to assess the potential hazard associated with the target process contaminants identified in each BRAC structure. The assessment criteria also depend on the structures intended future use (e.g., residential habitation, working environment, etc.). The assessment criteria assume that none of the BRAC structures which may potentially contain process contaminants will be used as housing facilities. The criteria provide protection to a level consistent with the requirements for protection of worker health and safety. Workers are assumed to be present in the structures for 8 hours per day, 5 days per week.



BRAC Base Realignment and Closure

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Figure 4-12

Future Use Assessment Flow Chart for BRAC Structures with Process Contaminants

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Dust sampling results should be assessed with regard to the potential for ingestion and dermal exposure. However, there are no regulatory standards for surface dust exposure. Appendix A contains the assessment criteria developed for the RMA future use structures. This criteria will be used to determine whether BRAC structures contain potential process contaminants above acceptable exposure limits. The assessment criteria (dust occupational assessment limits) with regard to dust ingestion for carcinogens were derived using published oral slope factors with an acceptable risk factor of 1×10^{-4}, and for noncarcinogenic analytes using published chronic oral reference dose (AGEISS, 1993b). Sample concentrations should be compared to the assessment criteria. However, when the potential for workers to be exposed to a mixture of contaminants exist, a combined exposure should be calculated and evaluated (see Appendix A). Assessment criteria for dermal contact consists of evaluating a combined exposure (ingestion and dermal contact) for detected contaminants in dust, by incorporating a factor for dermal exposure that is based on the fraction of contaminant absorbed through the skin (AGEISS, 1993b). Published data are used to determine the fraction absorbed through the skin, where available. If such data are not available, a factor of 0.50 can be applied.

Applicable OSHA and ACGIH criteria should be used to assess health risks from exposure to airborne contaminants. In cases where both OSHA and ACGIH provide air concentrations, the value that is most protective of the worker health and safety should be used as the assessment criterion. When available, 8-hour time weighted average (TWA) standards should be employed as assessment criteria. When 8-hour TWA standards are not available, 50 percent of the ceiling limit values should be used for those chemicals which have ceiling limits. Sample concentrations should be compared to the assessment criteria. However, when the potential for workers to be exposed to a mixture of airborne contaminants exist, a combined exposure should be calculated and evaluated (see Appendix A).

Treatment of Future Use Structures

If target process contaminants are detected in dust or air samples above assessment criteria, then the BRAC structure should be cleaned. Additionally, if operator knowledge indicates that a BRAC structure may contain dust or air contamination, the structure may be cleaned prior to sampling. In-situ treatment methods which can be used to clean a structure may include the following, used alone or in combination:

- Sweeping, vacuuming, or washing (using a low-pressure spray device) walls and floors to remove accumulated dust
- Steam cleaning, hydroblasting (using a high-pressure spray device), or grit blasting (using an abrasive material such as sand, steel pellets, alumina, or glass beads) to decontaminate the surface of walls and floors
- Drilling and spalling or scarification to remove a portion of the contaminated surface layer
- Encapsulation or removal of contaminated wall or floor materials

A number of the treatment methods are only applicable for certain structural materials or will only decontaminate specific process contaminants. For example, drilling and spalling and scarification are only applicable for concrete surfaces. On the other hand, grit blasting is not applicable for wall board, plastic or glass surfaces, and hydroblasting is not applicable for

glass, plastic, and wood surfaces. Section 4.4.5.2 lists additional in-situ treatment methods which are specified for debris, but may be applicable to structural surfaces. Applicability and hazards of implementation, success and cost of treatment, and volume of debris generated should be considered when selecting the treatment method. Emission control methods must be employed to reduce worker exposure and prevent the migration of contaminants during application of treatment methods that generate debris. Additionally, the treatment residuals must be sampled to determine whether they are RCRA hazardous (listed or characteristic). Section 4.4.5.2 describes the sampling and disposal requirements for treatment residuals.

Sampling of wall or floor material to determine the actual extent to which these materials may be contaminated, laterally as well vertically, may be warranted for those structures which contain small or discrete areas of potential contamination. If so the sampling procedures outlined in Section 4.4.5.2 for predemolition structure screening would be applicable. However, the cost associated with such sampling efforts, as well as the cost of treatment, may exceed the cost of encapsulation or removal and disposal of the material as hazardous. The cost-effectiveness would tend to decline for those structures which may contain large lateral areas of potential contamination or in which the contamination may likely have penetrated to a significant depth below the surface.

Dust and air in the BRAC structures should be resampled after treatment and proper cleanup procedures have been completed. If clearance testing indicates that sample results exceed the specified assessment criteria, the future use of the BRAC structure should be restricted. Such restrictions could include changing the intended use of the structure, limiting the extent of the structures use, or designating the structure as no future use which could mandate demolition. In order to minimize the Army's potential liability, restrictions should be detailed in the lease or transfer documents.

Prospective purchasers should be notified of potential process contaminant hazards, including information regarding the historic use of the BRAC structures. Additionally, sampling and assessment results should be provided. Results of sampling, assessment, or mitigation activities conducted with regard to BRAC structures should be documented as appropriate in any on-going or future EBS and/or RI/FS studies.

4.4.5.2 No Future Use Structures

The SPMP assumes that BRAC structures which will have no future use will be demolished. The process to be followed for characterization and management of process contaminants in these structures is outlined in Figure 4-11. Potential target process contaminants in each BRAC structures should be determined as part of the compilation of operator knowledge. Additionally, operator knowledge will be used to determine whether the demolished structures may generate debris that is listed hazardous waste or that exhibits characteristics of hazardous waste. The sampling approach discussed in this section is based in part on the sampling protocol developed for no future use structures at RMA (AGEISS, 1993a).

If operator knowledge is not sufficient to determine whether a BRAC structure contains process contaminants or whether the resulting debris will be RCRA hazardous, predemolition sampling should be conducted. Alternatively, if operator knowledge is sufficient to determine that a BRAC structure does not contain process contaminants and that demolition will not result in RCRA hazardous debris, the structure should be demolished without predemolition sampling. However, post-demolition sampling of the debris streams may be required to verify

categorization of the debris as nonhazardous. Additionally, when operator knowledge or predemolition sampling indicates that demolition of a structure will result in RCRA hazardous debris, predemolition sampling is not required. In this case, the structure should be demolished, the debris segregated, and post-demolition sampling conducted to determine which debris streams are hazardous and require treatment prior to disposal.

In-situ treatment of structures and/or treatment of debris streams should be required if RCRA hazardous debris will be generated during demolition of BRAC structures. Post-demolition or post-treatment sampling may be required to verify the effectiveness of this treatment. Sampling of residuals generated during treatment should also be required. Lastly, sampling may also be required to comply with off-site disposal facility acceptance criteria.

As discussed in Section 2.8.2.2, the Debris Rule contains provisions which apply to treatment and disposal of debris. The Debris Rule specifies treatment of contaminated debris based on material type and contaminant class. The following six categories of debris are specified:

- Metal objects (including drums, tanks, pipes, iron bars, and steel beams)
- Masonry materials (including brick, concrete, rock, asphalt paving, concrete sidewalks and pavement, cinder blocks, and clay tile)
- Wood (including wood furniture, pallets, plywood, walls and framing, wood floors, leaves, live vegetation, wood telephone and power poles, trees, and railroad ties)
- Rubber and plastic (including tires, hoses, battery cases, polyvinyl chloride piping, plastic bags, fiberglass tanks, and plastic sheets)
- Paper and cloth (including books, magazines, cardboard, paper packing, paper insulation, fiber drums, rags, and mattresses)
- Glass (including bottles, windows, beads, glass bricks, and glass containers)

Treatment methods for the various debris categories are also included in the Debris Rule. The treatment methods are referred to as best demonstrated available technologies (BDATs), and include extraction, destruction, and immobilization techniques. The final Debris Rule (57 Federal Register 37194) contains the performance standards and contaminant limitations for each type of treatment technology. Table 4-4 lists the BDATs indicated in the Debris Rule.

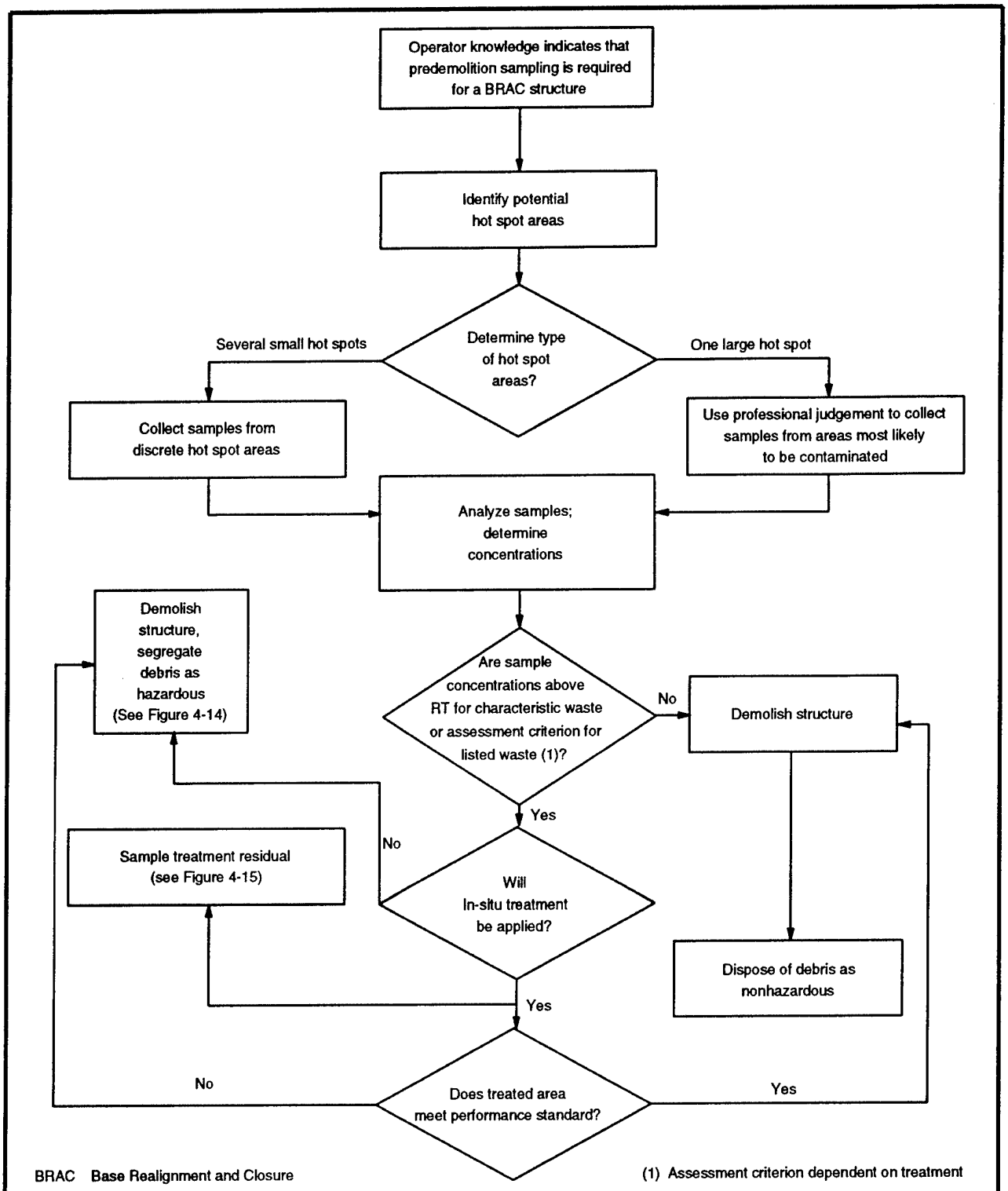
Debris that has been treated with the appropriate extraction or destruction BDAT to the specified performance standard is considered nonhazardous and can be managed as nonhazardous. However, debris that has been treated by an immobilization BDAT to the specified performance standard must be disposed of as hazardous.

Predemolition Structure Sampling and Treatment

Figure 4-13 identifies the process to be followed for predemolition structure sampling. Based on operator knowledge and visual inspection of the structure, potential hot spot areas are identified. Hot spots include those areas which have a high potential for contamination. Two types of hot spot areas can be identified, including discrete areas of small extent and larger, less well-defined areas. Examples of discrete hot spot areas include:

Table 4-4. Best Demonstrated Available Technology Treatment Methods for Debris.

EXTRACTION	Physical Abrasive blasting Scarification, grinding, and planing Spalling Vibratory finishing High pressure steam and water sprays
	Chemical Water washing and spraying Liquid-phase solvent extraction Vapor-phase solvent extraction
	Thermal High temperature metals recovery Thermal desorption
DESTRUCTION	Biodegradation Chemical oxidation Chemical reduction Thermal destruction
IMMOBILIZATION	Macroencapsulation Microencapsulation Sealing



BRAC Base Realignment and Closure
RT Regulatory Threshold

(1) Assessment criterion dependent on treatment

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Figure 4-13

Predemolition Structure Sampling for Process Contaminants

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- Lowest area in a sump or floor drain
- Areas of visual staining (e.g., floors, walls, etc.)
- Cracks or low spots in floors where spilled or leaked liquids may have collected
- Floor areas beneath removed process equipment
- Floor areas where hazardous materials may have previously been stored
- Wall areas behind removed process equipment, where visual staining is not apparent
- Other areas where contamination may have collected during industrial operations, based upon history of use, documentation of spills, or visual observations

Examples of potential larger hot spot areas include:

- Loading dock areas where historical evidence indicates that chemicals may have been handled, but where there is no visible evidence of spills
- Process or laboratory areas within a structure that is predominantly used for warehouse or administrative purposes
- Warehouse areas used for storage of hazardous materials, when predominant warehouse use was storage of nonhazardous materials

Sampling of structural material will be conducted by material type or by material types that can be treated using the same BDAT technology. A minimum of four samples will be collected from hot spot areas identified in each BRAC structure. Professional judgement or griding methods should be used to locate samples in the larger hot spot areas. The samples should not be composited. If one material type is present, or if more than one material type is present and the BDATs for each material are the same, then one set of four samples is required. A representative number of samples should be collected from each material type based on a weighted percentage of total material volume present. If two material types are present and BDATs are different for each material type, then two sets of samples are required. As samples are collected from similar use structures, trends can be established and the number of required samples may be minimized.

Samples should be collected using drilling and/or coring devices, the selected technique is based on the depth and type of materials to be sampled (AGEISS, 1993a). Samples should be collected from the top 2 inches of the structural material, unless there are indications that contamination has penetrated deeper.

The sample results should then be compared to the RT for characteristic or listed wastes. TCLP RTs for toxicity characteristic contaminants and LDRs (Constituent Concentrations in Waste (CCW) and Constituent Concentrations in Waste Extract (CCWE)) for listed waste constituents. If the individual sample results are greater than the RTs, then the debris that will be generated during demolition may exhibit a characteristic of hazardous waste or may contain constituents of listed hazardous waste. If in-situ treatment of the structure will not be conducted prior to demolition, the resulting debris should be segregated and handled as hazardous, as discussed below.

Treatment of those portions of the structure which are potentially contaminated based on operator knowledge or predemolition sampling results may be accomplished using BDAT techniques identified for debris. The use of BDATs to treat structural material prior to demolition may be safer, more efficient and cost effective, and may result in the minimization of the amount of hazardous debris and hazardous treatment residuals generated. The appropriate BDAT should be selected based on the type of structural material and process contaminants present, and the implementability of the technique. If the performance standard is achieved, the debris that will be generated during structure demolition can be disposed of as nonhazardous if extraction or destruction techniques were applied. However, post-demolition sampling may be required to verify the effectiveness of the in-situ treatment. If the performance standard was not achieved, the debris must be segregated and handled as hazardous. Residuals generated during the treatment process must also be sampled as discussed below, and cannot be combined with residuals from other treatment applications.

Post-Demolition Debris Sampling and Treatment

Figure 4-14 identifies the process to be followed when the debris streams generated by the demolition of a BRAC structure may be hazardous. Additionally, the assessment process also applies for post-demolition verification sampling of debris streams to confirm the effectiveness of in-situ treatment or the classification of debris as nonhazardous based on operator knowledge.

Debris generated during demolition should be segregated by material type, so that homogeneity of the material type by BDAT methods is maintained for sampling purposes. Each material type should be considered a separate debris stream, although those material types that can be treated by the same BDAT may be considered a single debris stream. Sampling of the debris streams should be conducted in a statistically random manner, following the sampling protocol described in Appendix B. This protocol is based on EPA guidance for solid and hazardous wastes as outlined in SW-846 (EPA, 1986b).

Equation B6 (found in Appendix B) should be used to calculate the number of samples initially required for a specific debris stream, or at a minimum four samples should be collected from each debris stream. Samples should not be composited. Samples should be collected after randomly determined percentages of the total debris volume for a particular debris stream has been stockpiled. If more than one material type comprises a debris stream, a representative number of samples should be collected from each material type based on a weighted percentage of total material volume present. As samples are collected from similar debris streams, trends can be established and the number of required samples may be minimized. Samples should be collected using drilling and/or coring devices, as described above.

Debris should remain stockpiled until the analytical results are assessed. The results should be used to determine if either the mean concentration or the upper limit of the CI for the true mean concentration is greater than the RT for characteristic wastes (see Appendix B). If listed wastes are of concern and the debris is untreated, the sample results should be compared to concentration-based LDRs (CCW and CCWE tables) to determine whether treatment is warranted. If sampling indicates that the debris is RCRA hazardous, treatment of the debris using the appropriate BDAT is required prior to off-site land disposal. Treatment residuals should be segregated from the treated debris, should not be combined with residuals from other treatment processes, and should be sampled as described below. Debris streams that are treated using extraction or destruction methods and that meet performance standards can

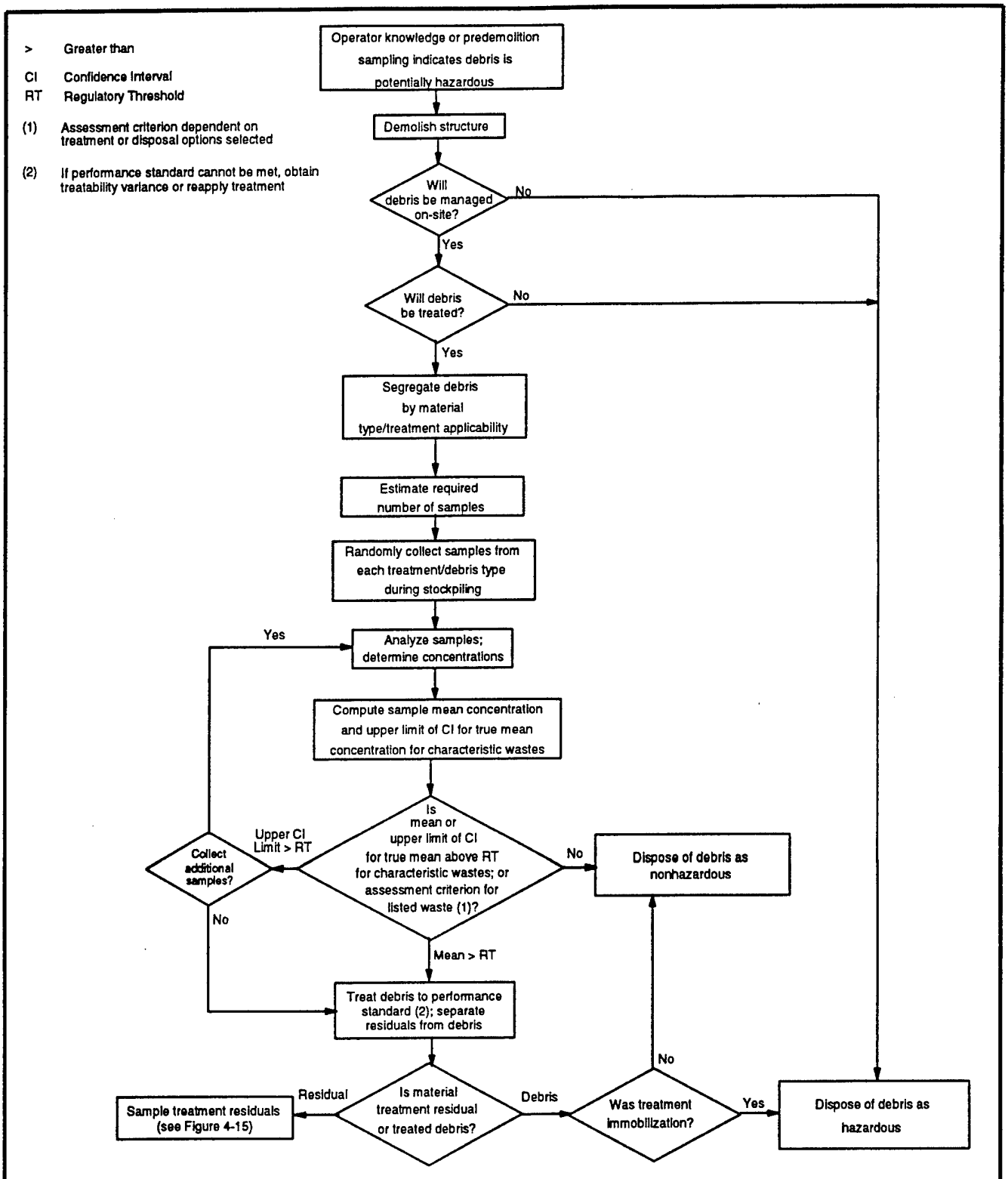

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Figure 4-14

Post-Demolition Debris Sampling for Process Contaminants

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be disposed as nonhazardous. However, debris streams that are treated by immobilization and meet the applicable performance standards must be managed and disposed of as hazardous. Post-treatment sampling may be necessary to document that the performance standards have been met. Additionally, post-treatment sampling may be required to meet off-site disposal facility acceptance criteria.

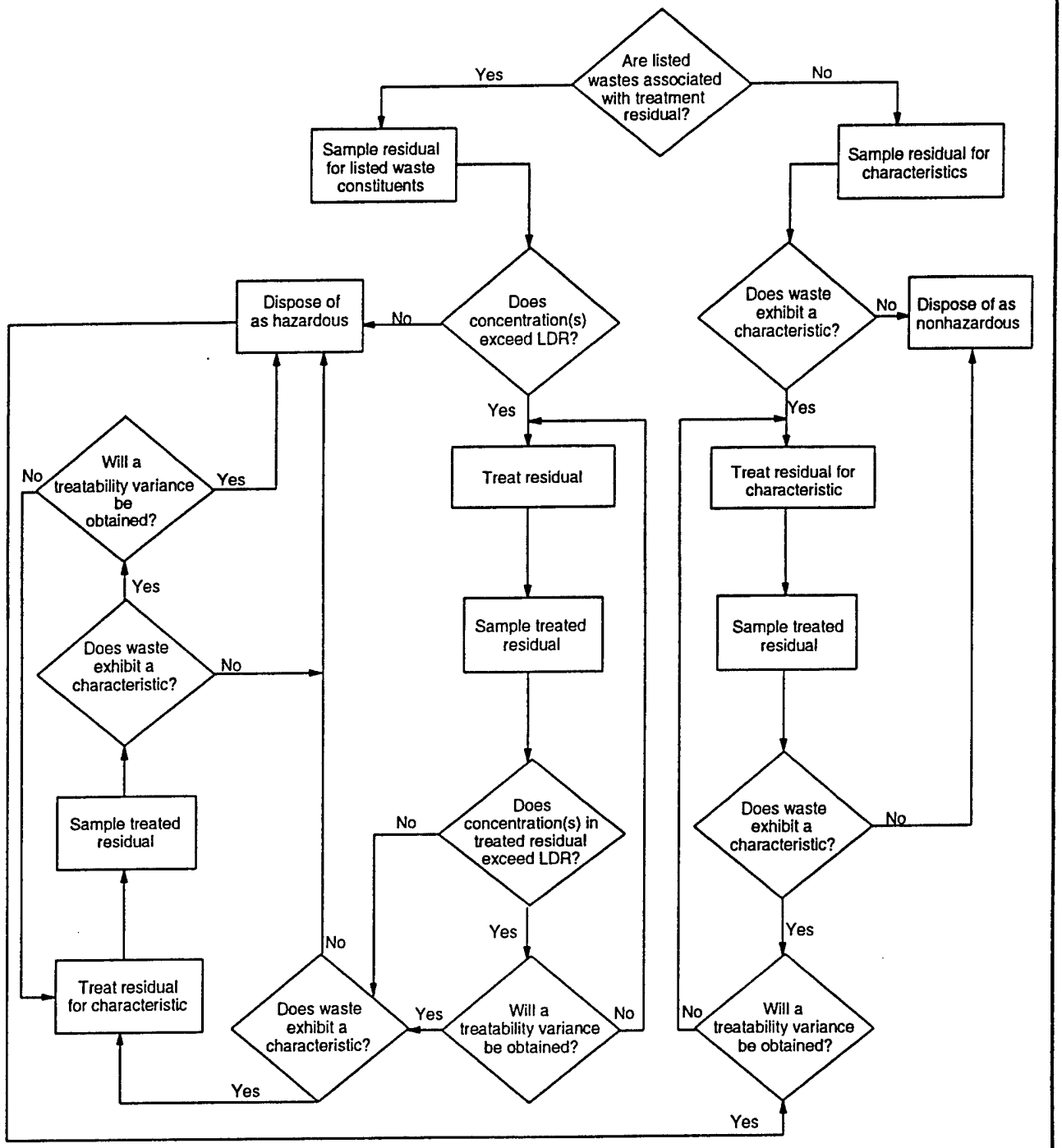
Treatment Residual Sampling

Figure 4-15 identifies the process to be followed for treatment residuals. Sampling should be conducted in a statistically random manner, similar to the method outlined for debris stream sampling and described in Appendix B.

At a minimum, two samples should be collected from each treatment residual stream. Samples should not be composited. Appropriate EPA-approved methods should be used to collect the samples depending on the nature of the residual (i.e., solid, liquid, or vapor). Samples should be collected after randomly determined percentages of the total volume for a particular treatment residual stream has been placed in an appropriate storage container.

The treatment residuals should remain stored until the analytical results are assessed. The results should be used to determine if either the mean concentration or the upper limit of the CI for the true mean concentration is greater than the RT for characteristic wastes (see Appendix B). Treatment of the residual stream will be required if the material exhibits a characteristic of hazardous waste. However, if the residual stream no longer exhibits a characteristic, the material can be disposed of as nonhazardous. A treatment residual containing listed wastes must be treated to meet the LDR concentration-based standards. Following treatment, the residual must be disposed of as hazardous.

Results of sampling, assessment, or mitigation activities conducted with regard to BRAC structures should be documented as appropriate in any on-going or future EBS and/or RI/FS studies.



LDR Land Disposal Restrictions (concentration-based standards)

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Figure 4-15
Post-Treatment Residual Sampling for Process Contaminants

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5.0 DOCUMENTATION AND DATA MANAGEMENT

The BRAC Cleanup Plan (DOD, 1993) should be consulted for general guidance regarding data management. The following discussion on documentation and data management is provided to augment existing requirements and to more fully develop the management of data generated during the structures investigation.

As discussed in Section 4.3, the BRAC structures should be inventoried and present and historical use information should be complied and assessed to determine whether the BRAC structures may contain potential hazards which must be addressed prior to disposal. Data collected through the review of existing databases or reports, interviews, and assessments should be complied into an overall operator knowledge database system. As additional data are collected during the course of the asbestos, radon, PCB, lead-based paint, or process contaminants characterization and management processes the new data should also be maintained in this database system.

An existing database can be utilized if available or a new database system can be created if conditions warrant. Individual databases can be set up to maintain graphics and drawings, historical use information, historical use assessments, sampling data, analytical results, mitigative information, debris stream and treatment residual tracking, etc. These individual databases should be related so that information from one database can be retrieved as needed and used with information contained in another database.

The Army's Installation Restoration Data Management Information System (IRDMIS) database could be used to store some of the information discussed in this section. However, the IRDMIS database requires specific data formatting and contains specific data fields, typically associated with chemical analyses results and sampling information. Therefore, the IRDMIS database will not be able to fully support the data management requirements discussed in this section, without the use of auxiliary databases.

5.1 GRAPHICS AND DRAWINGS DATABASE

A system to manage any created or existing maps, architectural drawings, engineering drawings, and schematics is needed to provide location and structural information. This could be a system of storing and retrieving drawings in hard copy form or using a computer-aided drafting and geographical information system to manage drawings in digital format, or a combination of both. The drawings should be organized so they can be identified by drawing number, referenced to the applicable BRAC structure(s), and easily retrieved and displayed.

5.2 HISTORIC USE INFORMATION DATABASE

Historic use information may come from a number of sources including existing databases, reports, or interviews. Existing data formats (e.g., notes, text, tables, or forms) may be adequate as is or it may prove to be more efficient and cost-effective to convert information to a digital database format to automate data queries. The historical use documents or digital base records should be organized so they can be identified by document number, referenced to the applicable BRAC structure(s), and easily retrieved.

5.3 HISTORIC USE ASSESSMENT DATABASE

As discussed in Section 4.3.2, the historical use information will be assessed to determine whether a BRAC structure may contain potential asbestos, radon, PCB, lead-based paint, or process contaminants hazards. Relevant information for each BRAC structure will be complied on individual historical use assessment forms. The forms may be filed as is or converted to a digital database format so that data queries can be automated. The decision to convert to a digital database base format would depend on cost-effectiveness and overall efficiency of data use. The individual historical use assessment forms or digital base records should be identified by structure number so they can be easily retrieved and compared to information contained in other databases (e.g., graphics, historical use information, sampling data, etc.).

5.4 SAMPLING INFORMATION DATABASE

As discussed in Section 4.4, sampling may be conducted during the characterization of the BRAC structures. The information pertaining to samples should be stored in the sampling information database. One database record will be maintained for each sample collected. The digital database should include the sample number, sample source (e.g., air, dust, structural material, debris stream, treatment residual), source reference number (e.g., structure, debris stream, or treatment residual number), sample location description, sample location drawing number (if applicable), sample type (e.g., original, duplicate, rinsate, trip blank, etc.), sample collection method, and analytical methods requested.

Using the sample source and source reference number, sample data can be related to the material from which it was collected. This relationship can be used to query all samples associated with a specific BRAC structure. Additionally, the sample location drawing number can be used to access schematics (if available) in the graphics database which document the locations where samples were collected.

5.5 ANALYTICAL RESULTS DATABASE

The analytical results for the samples can be obtained from the laboratories in digital and/or hard copy formats. However, the results should be stored in digital form in the analytical results database so that this information can be easily retrieved and manipulated. The database should contain the sample number, chemical parameter analyzed, detection or nondetection flags, concentration measurement, units of measure, applicable correction and dilution factors, and applicable accuracy and precision data for quality assurance/quality control samples.

The sample number will be used to relate analytical results back to their corresponding sample record in the sampling information database. Since a single sample may be analyzed using one or more analytical methods, and analytical methods test for one or more specific analytes, there will usually be many records in this database sharing the same sample number.

5.6 DEBRIS STREAM DATABASE

Information regarding the various debris streams that may be generated when material in a BRAC structure is treated or a BRAC structure is demolished should be stored in a digital

database to track and document debris streams from generation through final disposition. The debris stream database should contain the debris stream number, structure reference number, debris stream material description, preliminary hazard classification, sampling requirements, treatment(s) applied, final hazard classification, staging location prior to final disposition, and final disposition location.

Each debris stream will have a single record in the database and can be accessed using the debris stream number. Original structure source material or sampling information can be accessed using the structure reference number or relating the sampling information database using the debris stream number.

5.7 TREATMENT RESIDUAL DATABASE

Information regarding treatment residuals that may be generated when material in a BRAC structure or debris from a demolished BRAC structure is treated should be stored in a digital database to track and document treatment residuals from generation through final disposition. The treatment residual database should contain the treatment residual number, structure reference number, treatment residual material description, preliminary hazard classification, staging location prior to final disposition, and final disposition location.

Each treatment residual will have a single record in the data and can be accessed using the treatment residual number. Original structure source material or sampling information can be accessed using the structure reference number or relating the sampling information database using the treatment residual number.

APPENDIX A

ASSESSMENT CRITERIA FOR AIRBORNE CONTAMINANTS AND DUST

The following discussion is excerpted from the Final Structures Monitoring Protocol (AGEISS, 1993b) prepared for RMA future use structures. This discussion describes the development of assessment criteria for airborne contaminants and dust.

A1.0 ASSESSMENT CRITERIA FOR AIRBORNE CONTAMINANTS

For monitoring within the structures, applicable OSHA or ACGIH criteria are selected to assess health risks from exposure to airborne contaminants. In cases where both OSHA and ACGIH provide air concentrations, the value that is most protective of worker health and safety should be used as the assessment criterion. Eight-hour TWA standards are to be employed as assessment criteria when available. The 8-hour TWA standard is defined as the employee's average airborne exposure in any 8-hour work shift of a 40-hour work week which shall not be exceeded (29 CFR Part 1910.1000 (a)(5)(i)). For chemicals with no 8-hour TWA standards, 50 percent of the ceiling concentrations should be used as assessment criteria. The ceiling concentration is the employee's exposure which shall not be exceeded during any part of the work day (29 CFR Part 1910.1000 (a)(5)(iii)).

Measured air concentrations should be compared to the assessment criteria to determine if mitigation is required to protect worker health and safety. For structures where workers may be exposed to a mixture of airborne contaminants, the combined exposure should be evaluated using the following formula (29 CFR 1910.1000(d)(2)(i)):

$$E_m = (c_1/L_1) + (c_2/L_2) + \ldots (c_n/L_n) \qquad \text{(Equation A1)}$$

Where:	E_m	Exposure for a mixture
	c	Measured concentration of a particular contaminant
	L	Assessment criteria for the contaminant

The value of E_m calculated for each level (floor) of a structure should be used to evaluate worker exposure. Specifically, if the value of E_m is greater than 1 for mixtures on a structure level, consideration should be given to taking preventative measures to control worker exposure to airborne contaminants on that floor of the structure.

A2.0 ASSESSMENT CRITERIA FOR DUST - INGESTION

As there are no regulatory standards for surface dust exposure by ingestion, assessment criteria for dust should be derived from published oral toxicity data according to the methodology described below. The exposure parameters used to calculate dust assessment criteria apply to workers present in the structures 40 hours per week.

Assessment criteria for noncarcinogenic target analytes should be derived from published chronic oral reference doses (RfDs). The equation used to calculate these dust occupational assessment limits (DOALs) for noncarcinogens is as follows:

$$DOAL_{nc} = (RfD(DE)(BW)/ING) \times 10^6 \qquad \text{(Equation A2)}$$

Where:	$DOAL_{nc}$	Dust occupational assessment limit - noncarcinogen (milligrams (mg) of contaminant/kg of dust)) or ppm
	RfD	Reference dose (mg of contaminant/kg body weight/day)
	DE	Daily exposure factor (days/days)
	BW	Body weight (kg)
	ING	Ingestion rate (mg of dust/day)
	10^6	Units conversion factor (10^6 mg of dust/kg of dust)

A DE of 1.4 (e.g., 7 days/5 days) is used to adjust from the 7 days per week exposure assumed in the RfD to the 5 days per week assumed for the DOALs. The average adult body weight was assumed to be 70 kg (EPA, 1990c). The ING of dust is assumed to be 50 mg/day, based on the 95th percentile ING for the industrial worker used in the Draft Final Integrated Endangerment Assessment/Risk Characterization Report (Ebasco, 1992).

Assessment criteria for carcinogenic target compounds are derived from published oral slope factors (SF). A unit risk factor in mg/kg/day is first calculated using 1×10^{-4} as the acceptable risk (i.e., unit risk factor = (1×10^{-4})/SF). The unit risk factor is then adjusted to represent the daily occupational exposure to an adult worker that would result in an excess cancer risk no greater than 1×10^{-4}. The same values were used for the DE, BW, and ING for carcinogens as for noncarcinogens. The equation used to calculate DOALs for carcinogens is as follows:

$$DOAL_{ca} = ((1 \times 10^{-4}/SF)(DE)(BW)/ING) \times 10^6 \qquad \text{(Equation A3)}$$

Where:	$DOAL_{ca}$	Dust occupational assessment limit - carcinogen (mg of contaminant/kg of dust or ppm
	SF	Cancer slope factor $(mg/kg/day)^{-1}$
	DE	Daily exposure factor (days/days)
	BW	Body weight (kg)
	ING	Ingestion rate (mg/day)
	10^6	Units conversion factor (10^6 mg of dust/kg of dust)

Measured dust concentrations should be compared to the assessment criteria to determine if measures are required to protect worker health and safety during remediation activities. For structures where workers may be exposed to a mixture of dust contaminants, the combined exposure should be evaluated using Equation A1.

A3.0 ASSESSMENT CRITERIA FOR DUST - DERMAL EXPOSURE

There are no published standards available for dermal exposure, but OSHA has provided a "skin designation" for certain air contaminants. OSHA does not provide concentration-based and pathway-specific exposure standards for these substances, but identifies them as chemicals for which skin exposure shall be prevented or reduced to the extent necessary through the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls, or work practices (29 CFR 1910.1000(a)(4)).

For structures where dust analyses indicate detections of process contaminants with a "skin designation" or analytes that have not been evaluated by OSHA and it is likely workers in that structure could be exposed to dust through dermal contact, the combined exposure to dust contaminants (ingestion and dermal contact) should be evaluated using Equation A1, with the following modifications:

(Equation A4)

$$E_m = (c_1/L_1) + (c_1/L_1)ABS + (c_2/L_2) + (c_2/L_2)ABS + \ldots (c_n/L_n) + (c_n/L_n)ABS$$

Where:

E_m	Exposure for a mixture
c	Measured concentration of a particular contaminant
L	Assessment criteria for the contaminant
ABS	Fraction of contaminant absorbed through the skin

Equation A4 is based on the following assumptions:

- Workers are exposed to approximately equal amounts of dust by the ingestion route (50 mg/day) and dermal contact route (47 mg/day).
- The amount of dust workers are exposed to by dermal contact is estimated with the following formula: Dermal exposure = contact rate x skin area exposed (contact rate = 0.056 mg dust/square centimeter (cm^2) of skin (EPA, 1990c) and skin area exposed (hands) = 840 $cm^{2)}$(EPA, 1992).

The value of E_m calculated for each level (floor) of a structure should be used to evaluate worker exposure. Specifically, if the value of E_m is greater than 1 for mixtures on a structure level, consideration should be given to taking preventative measures to control worker exposure to dust contaminants on that floor of the structure.

The $[(c_n/L_n)ABS]$ term should only be included in the formula for those contaminants with a skin designation or that have not been evaluated by OSHA. Limited chemical-specific absorption data are available in Dermal Exposure Assessment: Principles and Application (EPA, 1992); these chemical-specific values for ABS should be used where available. In selecting appropriate factors, the various studies presented in the dermal exposure assessment handbook (EPA, 1992) should be evaluated to determine which study most closely approximates the conditions of exposure in a structure. A default value of 0.50 should be used for ABS when chemical-specific data are not available. This value corresponds to the upper end of the range of absorption fraction values presented in the dermal exposure assessment handbook (EPA, 1992) for soil-adhered organic compounds.

APPENDIX B

STATISTICAL SAMPLING OF DEBRIS AND TREATMENT RESIDUAL STREAMS

The following discussion is excerpted from the Final No Future Use Structures Sampling and Analysis Protocol (AGEISS, 1993a) prepared for RMA no future use structures. This discussion describes the development of the statistical sampling approach for debris and treatment residual streams and is largely based on EPA guidance contained in SW-846 (EPA, 1986b).

The simple random sampling approach can be used to represent structural debris by considering the various material types as separate units. Material types which can be treated using the same treatment technology should be combined and considered as one material type for sample determination and subsequent treatment. The method for determining the appropriate number of samples required to characterize a debris stream is estimated as follows:

(1) Obtain preliminary estimates of the mean concentration and variance of concentration for each chemical constituent of concern, using methods delineated in SW-846 and based upon existing data.

(2) Estimate the appropriate number of samples required to characterize the waste for each chemical constituent of concern, using methods delineated in SW-846. In general, the closer the preliminary estimate of the mean concentration is to the RT and the greater the estimated variance, the greater the number of samples that will be required.

(3) Randomly collect at least the number of samples estimated in Step 2. Accuracy and precision of the sampling will be improved by maximizing the physical size (weight and volume) of all samples collected.

(4) Extract and analyze the samples for each chemical contaminant of concern, using the appropriate method specified in SW-846. For characteristic wastes, the appropriate method will include extraction using the TCLP (Method 1311), followed by analysis using the appropriate SW-846 method (specified for the particular contaminant of concern, based upon chemical characteristics).

(5) Display the distribution of concentration data obtained through analysis graphically, and calculate the mean concentration, variance, standard deviation of the sample, standard deviation of the mean concentration, and CI for the true mean concentration as specified in SW-846.

(6) For each constituent of concern, if the mean concentration of that constituent is at or greater than the RT for that constituent, the portion of the medium (material type) represented by the sampling and analysis must be managed as hazardous. If the mean concentration of each constituent of concern is less than the RT for that constituent, the variance and standard deviation must be interpreted to determine whether the true mean concentration likely exceeds the RT (within specified levels of confidence - see Equation B5 listed below). If so, then the portion of the medium represented by the sampling and analysis is

characterized as hazardous (if it is a "close call," another round of sampling and analysis may be warranted; the decision to perform additional sampling and analysis should balance the cost of additional sampling and analysis against the cost differential for managing the medium as hazardous, according to SW-846). If not, then the portion of the medium represented by the sampling and analysis is characterized as nonhazardous, and can be managed as an ordinary solid waste.

The following equations are used in association with the SW-846 simple random method for sample number estimation and analysis of sample results (EPA, 1986b):

Sample Mean, $\bar{x}$ (Equation B1)

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

with n = number of sample measurements

Variance of Sample, s^2 (Equation B2)

$$s^2 = \frac{\sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n}}{n - 1}$$

Standard Deviation of Sample, s (Equation B3)

$$s = \sqrt{s^2}$$

Standard Error, $s_{\bar{x}}$ (Equation B4)

$$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

Confidence Interval for the True Mean Concentration, CI (Equation B5)

$$CI = \bar{x} \pm t_{.20} s_{\bar{x}}$$

$t_{.20}$ is obtained from a table of Student's "t" values for a probability of 0.20; the probability of 0.20 is recommended in SW-846

Appropriate Number of Samples, *n* (Equation B6)

$$n = \frac{t^2_{.20}\, s^2}{\Delta^2}$$

with $\Delta = RT - \bar{x}$

($t_{.20}$, s^2, and x are based on samples previously collected to establish preliminary estimates of mean concentration)

Degrees of Freedom, *df* (Equation B7)

$$df = n - 1$$

The number of samples required to represent a given volume of debris will be initially calculated using Equation B6 and existing historical data as discussed above. It should be noted that this method is applicable for wastes which exhibit a characteristic. If historical analytical data are lacking for a particular medium such that the mean concentration or variance cannot be calculated for use in Equation B6; or the material may contain a listed waste; four samples at a minimum will be used to represent the debris. The minimum number of samples was selected based upon the number required for a petition to exclude wastes from listing, as described in SW-846. Additionally, if the initial number of samples calculated using Equation B6 is less than four, the minimum of four samples will be collected.

The minimum number of samples chosen to represent treatment residuals is two samples. This lower number of minimum samples is based on the assumptions that treatment residuals will be relatively homogenous and of smaller volume than debris.